RECEIVED
DEC 3 -
VET. MED. LIBRARY

THE JOURNAL OF THE BRITISH VETERINARY ASSOCIATION

# The Veterinary Record

V. 69 - no 45
Nov. 9/57

PATRON: HER MAJESTY THE QUEEN

OHIO STATE UNIVERSITY
NOV 27 1957
LIBRARY

VOL. 69 NO. 45 ISSUE NO. 4153 1841-1860

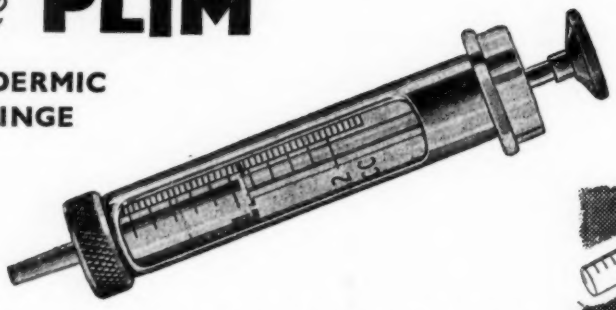
NOVEMBER 9th 1957

XUM

*A Product of* **ARNOLD** *of London*

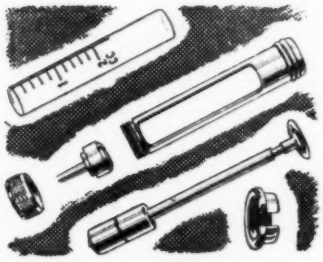
*The* **PLIM**

**HYPODERMIC SYRINGE**



★

**EVERY PART INTERCHANGEABLE**



- Hermetically sealed screw joints. No solder or cement used in construction.
- All metal parts Chromium Plated to resist chemical action. Nozzle and Piston of Stainless Steel.
- Spare Glass Barrels can be carried for instant replacement in case of damage.
- Can be sterilised at high temperature without fear of damage to the syringe.

**ARNOLD & SONS**

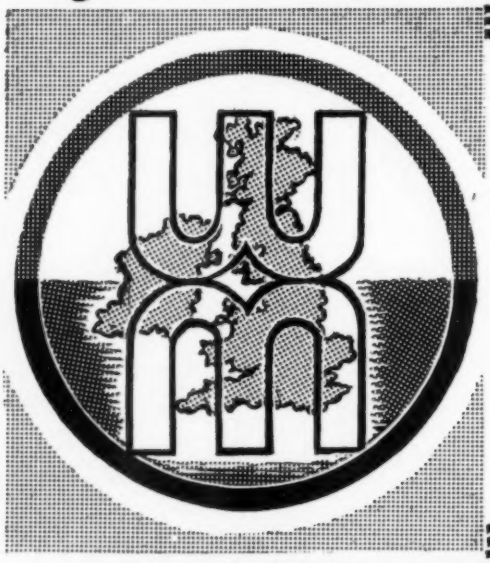
54, WIGMORE STREET, LONDON W.I. Telephone WELbeck 5555

*Branches at:*

EDINBURGH, BIRMINGHAM, BATH, YORK, READING, DUBLIN & AT GUELPH, CANADA

ARNOLD LONDON

**A *COMPREHENSIVE SERVICE COVERAGE* OF THE *UNITED KINGDOM***



✡

With headquarters at Shrewsbury, Willington Medicals, Ltd., extend, exclusively, to each Veterinary Surgeon in the United Kingdom, an unrivalled, comprehensive service of veterinary requirements, backed by many years of experience in their sole handling and distribution.

✡

**WILLINGTON MEDICALS LIMITED**

**ALPHA LABORATORIES, SHREWSBURY, ENGLAND**

The
# VETERINARY RECORD

Founded by William Hunting, F.R.C.V.S., in 1888

7, MANSFIELD STREET, PORTLAND PLACE, LONDON, W.1. MUSEUM 6541

No. 45 NOVEMBER 9th, 1957 Vol. 69

*Registered for Transmission as a Newspaper* *Price 2s. post free*

## The Application of Magnesium Compounds to Pasture for the Control of Hypomagnesaemia in Grazing Cattle: A Comparison between Magnesian Limestone and Calcined Magnesite

BY

**W. H. PARR and RUTH ALLCROFT**

**Ministry of Agriculture, Central Veterinary Laboratory, Weybridge**

*SUMMARY.*—1. *Pasture was heavily manured with ammonium sulphate in an attempt to produce hypomagnesaemia in grazing cows.*

2. *The effect of 2½ tons magnesian limestone per acre in preventing hypomagnesaemia in cows grazing such pasture was compared with that of 10 cwt. of calcined magnesite per acre, which supplied the same amount of magnesium.*

3. *The calcined magnesite was more effective in raising the pasture magnesium content and in preventing hypomagnesaemia. It increased the pasture magnesium content by an average of 73 per cent. compared with 23 per cent. for the pasture manured with magnesian limestone.*

4. *These results suggest that calcium may influence the uptake of magnesium by pasture.*

5. *A seasonal trend in the magnesium content of the pasture was observed. The magnesium content of pasture treated with the calcined magnesite also appeared to vary according to the stage of growth.*

6. *The potential value of magnesium manures as a practical means of preventing hypomagnesaemia is briefly discussed.*

THE factors which give rise to hypomagnesaemia have not been completely established. The evidence available shows that the magnesium contents of pastures on which it occurs are not necessarily lower than those on which serum magnesium levels remain normal. The increased incidence of hypomagnesaemia has been associated in agricultural circles with intensified grassland production. Evidence obtained by Bartlett, Brown, Foot, Rowland, Allcroft and Parr (1954) on the incidence of "grass tetany" under carefully controlled experimental conditions supported this view. Later work (Head & Rook, 1955; Balch, Head, Line, Rook & Rowland, 1956) showed that the increased nitrogen content of intensively produced grass caused an increase in rumen ammonia levels and these authors suggested that this might interfere with the absorption of magnesium from the alimentary tract. They found also that the magnesium intake of cows fed an all grass ration was only about 50 per cent. of that on a stall ration.

There is a good deal of evidence which shows that an increase in the magnesium intake of cattle can prevent, or at least ameliorate the fall in serum magnesium levels. Observations on the use of oral supplements of calcined magnesite (Allcroft, R., 1954) showed this to be very effective under certain conditions; these observations have been widely confirmed in farming experience. There are, however, considerable difficulties involved in the use of this procedure particularly on farms where the aim is to maintain the animals only on grass and its products. When good grass is abundant many farmers are reluctant to feed even the small amount of concentrates which are necessary as a carrier for the supplement. These factors also apply to beef herds, dry cows and young stock at grass. Increased labour requirements and reluctance of grazing animals to eat the supplement when ample grass is available are added difficulties.

In view of this, there is good reason for examining the possibilities of increasing the magnesium intake of grazing animals by increasing the magnesium content of the pasture. There are two possible approaches to this aspect. In the first place the magnesium intake of the grazing animal can be increased by spraying the pasture with a soluble magnesium compound, or preferably dusting it with calcined magnesite immediately before grazing. Although this may be of value under certain conditions it involves a good deal of extra labour and is not suitable as a general routine in farm management. The other approach is that of raising the magnesium content of pasture by the use of magnesium fertilisers in such a way as to increase the magnesium concentration within the plant to levels which will maintain normal serum magnesium levels in the grazing animal. This aspect has been studied in the present work.

The application of magnesium compounds to pasture was first studied by Cunningham (1936) in New Zealand. He found that 8 cwt. of magnesium sulphate per acre caused an increase of about 18 per cent. in the magnesium content of the sward, and this effect persisted for about 12 months. An equivalent dressing of dolomite showed a much more delayed and less persistent effect than the magnesium sulphate. Larger applications of magnesium sulphate (1 to 2 tons per acre) gave proportionately larger (40 to 60 per cent.) increases in the magnesium content of the sward. Although these dressings appreciably increased the magnesium content of the sward, it was not considered that the intake of magnesium by the grazing animal could be increased economically by these methods. The first attempt in this country to raise the magnesium intake of cattle by the application of a magnesium manure to pasture was that of Bartlett *et al.* (1954). In this case the use of 25 cwt. per acre of calcined magnesite (a commercial product containing about 90 per cent. MgO) raised the magnesium content of spring pasture by nearly 100 per cent. and this was shown to be beneficial in controlling hypomagnesaemia in cattle grazing the treated pasture. Subsequently, Reith (1954) showed that magnesian limestone dressings increased the magnesium content of mixed herbage throughout the growing season by at least 50 per cent. above that of similar but untreated herbage. This work was extended by Stewart and Reith (1956) who again obtained increases in the magnesium content of pastures which had been dressed with magnesian limestone (2 ton per acre) on commercial farms. They were not able to arrange a strictly controlled experiment, but they were satisfied that the increased magnesium level in the herbage had a beneficial effect in maintaining serum magnesium levels of cattle grazing the treated pasture.

Studies of the value of magnesium limestone dressings under controlled conditions and comparison of their effects with those of dressings of calcined magnesite are now being carried out at this laboratory. From an economic point of view this is of importance to the farmer, since the use of magnesian limestone can be reasonable in cost under certain conditions, while calcined magnesite is imported and its cost per ton is relatively high.

## Experimental

*Procedure*

A field of approximately 8 acres on a Laboratory farm near Weybridge was acquired early in 1955. It had been cropped with wheat in 1954 and undersown with a seed mixture of cocksfoot, perennial ryegrass and clover. The soil was light and sandy, being of a "Bagshot sand" formation, with a fairly low lime status. This, combined with the bad harvesting conditions in 1954 resulted in a bad take of clover which was more or less entirely eliminated by the high nitrogen dressings applied during the experiment. The final sward consisted mainly of cocksfoot and perennial ryegrass, with the former being the predominant species.

The field was divided by wire fences into 4 equal plots of 2 acres each. All received dressings of triple superphosphate at the rate of 1 cwt. per acre in March, 1955, and 2 cwt. per acre in March, 1956. Plots 2, 3 and 4 also received 6 cwt. of sulphate of ammonia per acre each year, given in two applications each of 3 cwt. per acre in March and April. In addition, in January, 1955, Plot 3 was treated with 10 cwt. of calcined magnesite per acre, and Plot 4 with 2½ tons of magnesian limestone per acre. The amounts of calcined magnesite and magnesian limestone were calculated to supply the same amount of magnesium per acre. These applications of magnesium were not repeated in 1956. The manurial treatments are summarised in Table I. For convenience the plots will subsequently be referred to as: *Plot* 1 (control); *Plot* 2 (N); *Plot* 3 (N, Mg) and *Plot* 4 (N, Mg-Ca) respectively.

In the spring of 1955, and again in 1956, milking cows were changed abruptly from stalls to the experimental plots, 4 cows going on to each except that only 3 were available for Plot 1 (control) in 1956. There was thus a sudden change from stall rations to spring grass, but because of dry and rather cold conditions which existed in both years, sufficient grass was not available until near the beginning of May. Strip grazing was employed and the electric fence was moved forward about 10 yards every other day, although it was necessary to move it further on the control plot than on the other 3 because of the slower rate of growth of the grass on this plot compared with that on the other 3 which received sulphate of ammonia.

Pasture samples were taken prior to any of the manurial applications, and then at monthly intervals when growth permitted. At each of these samplings only one sample was taken from each plot, care being taken to ensure that it was as representative as possible. In addition, when strip grazing was employed in the spring a pasture sample was taken from the new strip on each plot every time the fence was moved forward. The samples were analysed for calcium, magnesium, phosphorus and protein by the methods generally employed at this laboratory. Blood samples were taken from the cows 2 to 3 times before they were turned on to the pasture, after which they were bled 3 times a week for 2 weeks and then twice weekly. The blood samples were analysed for calcium, magnesium and inorganic phosphorus.

TABLE I

MANURIAL TREATMENT OF THE EXPERIMENTAL PLOTS

| Date of application | Plot 1 (Control plot) | Plot 2 (Nitrogen) | Plot 3 (Nitrogen + calcined magnesite) | Plot 4 (Nitrogen + magnesian limestone) |
|---|---|---|---|---|
| 13.1.55 | | | | 2½ tons per acre of magnesian limestone |
| 27.1.55 | | | 10 cwt. per acre of calcined magnesite | |
| 25.3.55 | 1 cwt. per acre triple superphosphate | 1 cwt. per acre triple superphosphate<br>3 cwt. per acre sulphate of ammonia | 1 cwt. per acre triple superphosphate<br>3 cwt. per acre sulphate of ammonia | 1 cwt. per acre triple superphosphate<br>3 cwt. per acre sulphate of ammonia |
| 25.4.55 | | 3 cwt. per acre sulphate of ammonia | 3 cwt. per acre sulphate of ammonia | 3 cwt. per acre sulphate of ammonia |
| 14.3.56 | 2 cwt. per acre triple superphosphate | 2 cwt. per acre triple superphosphate | 2 cwt. per acre triple superphosphate | 2 cwt. per acre triple superphosphate |
| 15.3.56 | | 3 cwt. per acre sulphate of ammonia | 3 cwt. per acre sulphate of ammonia | 3 cwt. per acre sulphate of ammonia |
| 17.4.56 | | 3 cwt. per acre sulphate of ammonia | 3 cwt. per acre sulphate of ammonia | 3 cwt. per acre sulphate of ammonia |

## Results

*Pasture Composition*

After the application of calcined magnesite and of magnesian limestone a very marked increase in the magnesium content of the pasture occurred for the next 3 months, much of which is believed to be due to contamination on the outside of the leaves in spite of attempts to wash the samples. The small amount of growth at that time of the year was no doubt a factor which contributed to the contamination. When satisfactory growth commenced it was possible to obtain samples free from contamination and the results for May, 1955, and after almost certainly represent magnesium within the plant structure.

The results obtained up to the time of preparing this report are presented in Fig. 1 (overleaf). For the purpose of clarity the average of the magnesium results for samples from Plots 1 (control) and 2 (N) at each date were used in drawing the graph, since the differences between the magnesium contents of these 2 plots was shown to be statistically not significant (see Table II). The data are summarised in Table II where each of the values given is the mean of 34 different samplings; the high results obtained during the first 3 months after the application of the magnesium manures were omitted when computing the means. The mean calcium and phosphorus contents have also been included in the Table.

TABLE II

MEAN CALCIUM, MAGNESIUM AND PHOSPHORUS CONTENTS OF EXPERIMENTAL PASTURE (AS PER CENT. DRY WEIGHT)

| | CaO per cent. | MgO per cent. | $P_2O_5$ per cent. |
|---|---|---|---|
| Plot 1 (Control) ... | 0·62 | 0·25 | 0·80 |
| „ 2 (N) ... ... | 0·55 | 0·26 | 0·86 |
| „ 3 (N, Mg) ... | 0·49 | 0·45 | 0·81 |
| „ 4 (N, Mg-Ca) ... | 0·64 | 0·32 | 0·84 |

The significance of the difference in the magnesium results between Plots 2 and 1 and 4 and 2 were examined statistically by applying the $t$ test to the standard error of the mean difference. The results are given in Table III, together with the differences between Plots 3 and 2 and Plots 3 and 4. A formal test of significance was not applied in these cases since the differences were clearly significant on inspection.

TABLE III

STATISTICAL ASSESSMENT OF THE MAGNESIUM (MgO) RESULTS GIVEN IN TABLE II

| Comparison | Mean Difference | t | P |
|---|---|---|---|
| Plot 2 : Plot 1 | +0·01 | 1·315 | 0·2 |
| „ 3 : „ 2 | +0·19 | | |
| „ 4 : „ 2 | +0·06 | 8·26 | 0·001 |
| „ 3 : „ 4 | +0·13 | | |

It can be seen that the magnesium content of the pasture on Plot 2 (N) tends to be slightly higher than that for Plot 1 (control) although the difference is not statistically significant. Plot 3 (N, Mg), which received the calcined magnesite in addition to the other manurial treatments, shows a magnesium level which is on average about 73 per cent. higher than that for Plot 2 (N). The plot which received the magnesian limestone, Plot 4 (N, Mg-Ca), shows a magnesium level which is about 24 per cent. higher than Plot 2 (N) and this difference is statistically highly significant.

Reith (1954) and Cunningham (1936) reported a seasonal trend in pasture magnesium and the results shown in Figure 1 indicate a similar seasonal trend on each plot apart from the differences in pasture magnesium content between the plots. The magnesium content increased from the beginning of June, 1955, reaching a maximum in September-October in the same year and then falling off again in January, 1956. This was followed by a further increase by April, 1956, when the levels again fell until the end of May and then tended to rise again. These variations were most marked on Plot 3 (N, Mg), where they could be closely correlated with the

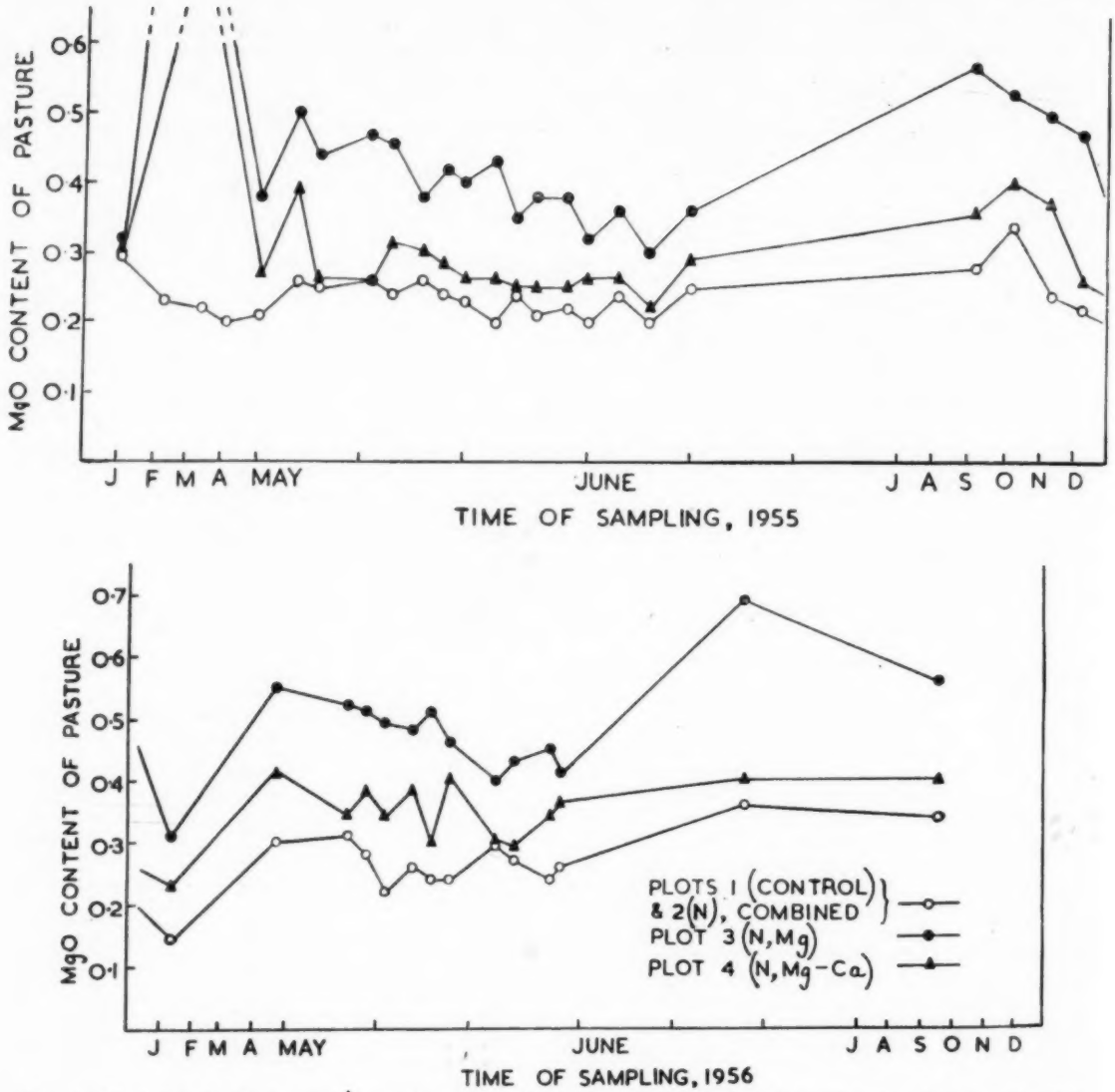



FIG. 1.—Variations in the magnesium content, expressed as per cent. MgO in dry matter, of pasture from experimental plots which received the fertiliser treatments given in Table I.

stage of growth of the pasture. On this plot there was a marked fall in the magnesium content of the pasture from the beginning of May to early June in 1955 and from April to late May in 1956, which coincided with the increasing maturity of the pasture. The maximum values on this plot in September, 1955, and June, 1956, occurred at the times of appearance of young rapidly growing grass. The first was associated with the autumn flush, and the second with the occurrence of heavy rain following the dry spring in 1956.

In contrast to its slight effect on the magnesium content of the pasture on Plot 2 (N), the application of sulphate of ammonia appears to have brought about a decrease in its calcium content in comparison with that of Plot 1 (Mean difference—0.07, $t=2.30$, $P=0.02$). It also appears that this depression has been further increased by the application of calcined magnesite on Plot 3 (N, Mg). (Mean difference Plot 3: Plot 2 = $-0.06$, $t=3.88$, $P=0.001$).

*Serum Magnesium Levels*

The mean serum magnesium levels for the groups of cows turned on to each of the four plots in spring, 1955 and spring, 1956 are illustrated in Figs. 2 and 3, respectively, while the individual results are presented in Tables IV and V. In 1955 hypomagnesaemia

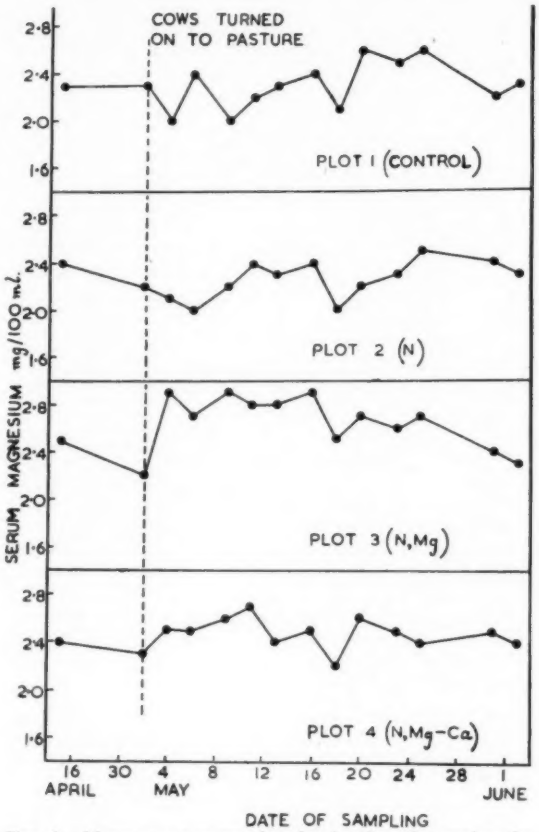



FIG. 2.—Mean serum magnesium levels of cattle grazing the experimental plots, 1955.

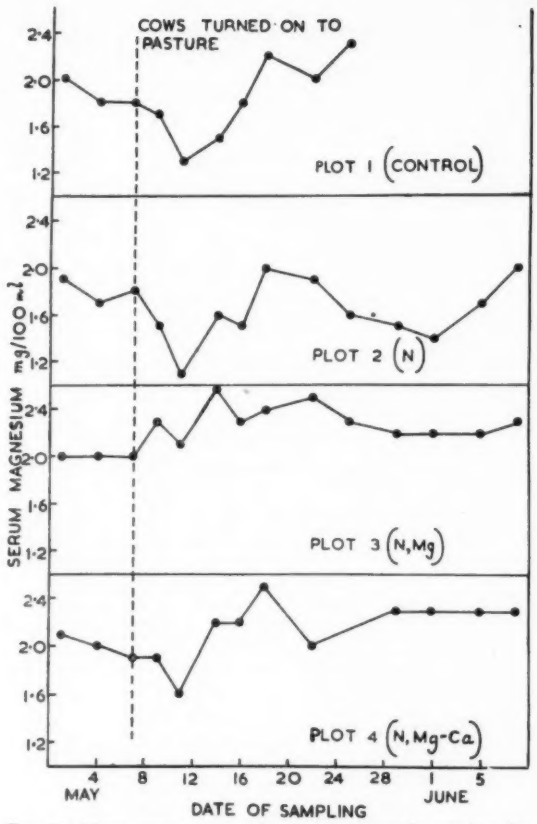



FIG. 3.—Mean serum magnesium levels of cattle grazing the experimental plots, 1956.

occurred in only 2 of the cows; No. 3572 on Plot 1 (control) and 3580 on Plot 2 (N), but the cows grazing on Plot 3 (N, Mg) showed a marked increase in serum magnesium levels compared with those on Plots 1 (control) and 2 (N). This is of interest in view of the fact that oral administration of magnesium sulphate (Allcroft, W. M., 1947), or magnesium oxide (Allcroft, Ruth, 1954) to cattle with normal serum magnesium levels did not increase these levels, although Cunningham (1934) found it possible to increase serum magnesium of normal sheep by drenching them with magnesium sulphate solution. The cows on Plot 4 (N, Mg-Ca) showed a slight increase in serum levels, intermediate between those on Plots 1 and 2 and of Plot 3.

In the following year (1956) all the cows on Plot 2 (N) showed low serum magnesium levels, while 2 of the 3 cows on Plot 1 (control) also showed low levels, although the fall did not persist so long as in those on Plot 2 (N). The cows on Plot 3 (N, Mg) showed no hypomagnesaemia with the exception of two individual values of 1.7 and 1.6 mg. p.c. for cow 3583, and in fact an increase in their serum magnesium levels again occurred after they were turned on to the plot. In this year the cows on Plot 4 (N, Mg-Ca) showed a transient decrease in serum magnesium to below normal levels, followed by a return to levels above that which existed before turning out, and of the same order as those in the cows on Plot 3 (N, Mg). This variation was not observed by Stewart and Reith (1956) but they did not take blood samples until a fortnight after the animals were turned on to the pasture top-dressed with dolomite.

The clinical case which occurred on Plot 2 (N) in 1956, as mentioned above, is perhaps worthy of individual mention. Following calving in February 1956 she developed a hypomagnesaemia while indoors and fed on a stall ration. This appeared to be of a chronic type and her serum magnesium level returned to the normal range only when she was given calcined magnesite daily in her concentrate ration. This chronic hypomagnesaemia was accompanied by a marked loss of condition, although no other symptoms were observed while she was indoors. When she was turned on to Plot 2 (N) her magnesium level was 1.1 mg. p.c. which was below the normal range. It fell rapidly while she was at pasture and clinical symptoms of tetany occurred 6 days after turning out. A blood sample was taken prior to the injection of magnesium sulphate and the following day a further blood sample again showed a low blood magnesium level and symptoms of incoordination reappeared. At this stage the cow was

TABLE IV

SERUM MAGNESIUM LEVELS IN MG. PER 100 ML. OF INDIVIDUAL COWS GRAZING THE EXPERIMENTAL PLOTS IN 1955

| Cow number | Date | 25.4 | 2.5* | 4.5 | 6.5 | 9.5 | 11.5 | 13.5 | 16.5 | 18.5 | 20.5 | 23.5 | 25.5 | 31.5 | 2.6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Plot 1 (Control* | | | | | | | | | | | | | | | |
| 3565 | ... ... | 2·2 | 2·1 | 2·3 | 2·7 | 2·5 | 2·5 | 2·8 | 2·7 | 2·6 | 2·7 | 2·5 | 2·8 | 2·4 | 2·3 |
| 3572 | ... ... | 2·1 | 2·2 | 2·0 | 2·5 | 1·4 | 1·5 | 1·6 | 2·1 | 1·8 | 2·1 | 2·3 | 2·2 | 2·1 | 2·4 |
| 3583 | ... ... | 2·6 | 2·3 | 1·7 | 2·2 | 1·9 | 2·4 | 2·4 | 2·5 | 2·2 | 3·1 | 2·6 | 2·9 | 2·3 | 2·4 |
| 3642 | ... ... | 2·3 | 2·6 | 2·1 | 2·2 | 2·4 | 2·3 | 2·3 | 2·3 | 1·9 | 2·5 | 2·8 | 2·7 | 1·9 | 2·1 |
| *Plot 2 (N)* | | | | | | | | | | | | | | | |
| 3566 | ... ... | 2·2 | 2·1 | 2·4 | 2·2 | 2·2 | 2·7 | 2·5 | 2·9 | 2·3 | 2·9 | 2·7 | 2·8 | 2·5 | 2·3 |
| 3568 | ... ... | 2·0 | 2·0 | 2·2 | 2·2 | 2·3 | 2·7 | 2·5 | 2·7 | 2·6 | 2·7 | 2·7 | 2·8 | 2·5 | 2·5 |
| 3579 | ... ... | 2·6 | 2·3 | 2·0 | 1·8 | 2·2 | 2·4 | 2·5 | 2·6 | 2·0 | 2·3 | 2·3 | 2·7 | 2·7 | 2·0 |
| 3580 | ... ... | 2·8 | 2·5 | 1·9 | 1·7 | 2·1 | 2·0 | 1·8 | 1·2 | 1·0 | 1·1 | 1·5 | 1·9 | 1·7 | 2·4 |
| *Plot 3 (N, Mg)* | | | | | | | | | | | | | | | |
| 3569 | ... ... | 2·8 | 2·1 | 2·9 | 2·2 | 2·9 | 2·9 | 2·9 | 3·2 | 2·9 | 3·1 | 3·1 | 3·2 | 2·5 | 2·6 |
| 3581 | ... ... | 2·6 | 2·4 | 2·9 | 3·1 | 2·8 | 2·7 | 2·5 | 2·7 | 2·4 | 3·0 | 2·8 | 2·9 | 2·5 | 2·2 |
| 3582 | ... ... | 2·3 | 2·3 | 2·7 | 2·8 | 2·9 | 3·0 | 2·9 | 2·8 | 2·2 | 2·2 | 1·9 | 2·0 | 1·7 | 1·7 |
| 3584 | ... ... | 2·4 | 2·2 | 3·0 | 2·8 | 3·0 | 2·6 | 2·7 | 2·8 | 2·4 | 2·5 | 2·8 | 2·8 | 2·5 | 2·4 |
| *Plot 4 (N, Mg-Ca)* | | | | | | | | | | | | | | | |
| 3294 | ... ... | 2·4 | 2·4 | 2·3 | 2·6 | 2·7 | 2·7 | 2·5 | 2·3 | 1·9 | 2·2 | 2·2 | 2·2 | 2·6 | 2·2 |
| 3570 | ... ... | 2·3 | 2·2 | 2·8 | 2·6 | 2·8 | 2·8 | 2·2 | 2·5 | 2·3 | 2·7 | 2·5 | 2·9 | 2·5 | 2·5 |
| 3571 | ... ... | 2·4 | 2·0 | 2·4 | 2·4 | 2·5 | 2·7 | 2·3 | 2·8 | 2·2 | 2·7 | 2·7 | 1·9 | 2·4 | 2·4 |
| 3641 | ... ... | 2·5 | 2·5 | 2·6 | 2·5 | 2·5 | 2·6 | 2·7 | 2·5 | 2·3 | 2·7 | 2·5 | 2·7 | 2·7 | 2·5 |

* Cows turned on to the plots on 2.5.55, after the blood samples were taken.

TABLE V

SERUM MAGNESIUM LEVELS IN MG. PER 100 ML. OF INDIVIDUAL COWS GRAZING THE EXPERIMENTAL PLOTS IN 1956

| Cow number | Date | 1.5 | 4.5 | 7.5* | 9.5 | 11.5 | 14.5 | 16.5 | 18.5 | 22.5 | 25.5 | 29.5 | 1.6 | 5.6 | 8.6 | 12.6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Plot 1 (control)* | | | | | | | | | | | | | | | | |
| 3572 | ... ... | 2·2 | 2·0 | 1·9 | 1·8 | 1·2 | 1·3 | 2·0 | 2·3 | 2·2 | 2·4† | 2·5 | 2·0 | 2·2 | 2·4 | 2·3 |
| 3580 | ... ... | 1·4 | 1·4 | 1·5 | 1·0 | 0·7 | 1·2 | 1·3 | 1·7 | 1·5 | 2·0† | 2·4 | 2·1 | 2·2 | 2·3 | 2·2 |
| 3642 | ... ... | 2·4 | 2·2 | 2·1 | 2·4 | 1·9 | 2·1 | 2·1 | 2·5 | 2·3 | 2·5† | 2·5 | 2·3 | 2·2 | 2·5 | 2·4 |
| *Plot 2 (N)* | | | | | | | | | | | | | | | | |
| 3566 | ... ... | 1·8 | 1·6 | 1·8 | 1·7 | 1·3 | 1·6 | 1·2 | 1·8 | 1·8 | 1·6 | 1·6 | 1·4 | 1·7 | 2·0 | 2·1 |
| 3569 | ... ... | 2·2 | 2·1 | 2·1 | 1·9 | 1·5 | 1·5 | 1·2 | 1·7 | 1·8 | 1·6 | 1·4 | 1·0 | 1·6 | 2·0 | 1·8 |
| 3571 | ... ... | 1·9 | 1·9 | 2·2 | 1·8 | 1·2 | 1·6 | 2·0 | 2·4 | 2·2 | 1·6 | 1·6 | 1·7 | 1·8 | 2·0 | 2·0 |
| 3582 | ... ... | 1·6 | 1·2 | 1·1 | 0·7 | 0·5‡ | 1·6‖ | 0·6¶ | 1·0 | 1·0 | 0·9 | 0·9 | 1·1 | 1·4 | 1·6 | 1·8 |
| *Plot 3 (N, Mg)* | | | | | | | | | | | | | | | | |
| 3294 | ... ... | 2·3 | 2·2 | 2·1 | 2·5 | 2·4 | 2·5 | 2·4 | 2·4 | 2·3 | 2·5 | 2·4 | 2·4 | 2·2 | 2·3 | 2·3 |
| 3565 | ... ... | 2·1 | 2·1 | 2·1 | 2·5 | 2·4 | 2·8 | 2·3 | 2·1 | 3·0 | 2·5 | 2·5 | 2·6 | 2·3 | 2·6 | 2·6 |
| 3568 | ... ... | 1·6 | 1·9 | 1·7 | 2·2 | 2·1 | 2·6 | 2·3 | 2·5 | 2·7 | 2·3 | 2·5 | 2·6 | 2·3 | 2·6 | 2·6 |
| 3583 | ... ... | 2·0 | 1·9 | 2·0 | 2·0 | 1·7 | 2·4 | 2·1 | 2·4 | 1·9 | 2·0 | 1·9 | 1·6 | 2·1 | 2·2 | 2·4 |
| *Plot 4 (N, Mg-Ca)* | | | | | | | | | | | | | | | | |
| 3570 | ... ... | 2·2 | 2·0 | 2·0 | 1·7 | 1·6 | 2·6 | 2·4 | 2·4 | 1·8 | 2·1 | 2·2 | 2·7 | 2·4 | 2·2 | 2·3 |
| 3579 | ... ... | 2·1 | 1·9 | 1·6 | 1·4 | 1·3 | 2·3 | 2·3 | 2·5 | 1·9 | — | 2·2 | 2·2 | 2·2 | 2·5 | 2·4 |
| 3581 | ... ... | 2·0 | 2·1 | 2·1 | 2·3 | 1·5 | 1·8 | 2·3 | 2·7 | 2·1 | 2·7 | 2·4 | 2·2 | 2·5 | 2·5 | 2·5 |
| 3641 | ... ... | 2·2 | 2·1 | 1·9 | 2·1 | 2·1 | 2·2 | 2·0 | 2·3 | 2·2 | 2·5 | 2·4 | 2·3 | 2·2 | 2·2 | 2·4 |

* Cows turned on to the plots on 7.5.56.
† Cows transferred to other plots on 25.5.56.
‡ Cow 3582 showed clinical symptoms of hypomagnesaemia on 13.5.56.
‖ Post-injection sample.
¶ Transferred to Plot 3 (N, Mg) on 16.5.56.

transferred to Plot 3 (N, Mg). This produced a slight increase in her serum magnesium level, but as a result of tetany she had suffered a hip-joint injury and spent much time lying down, grazing only for very short periods. However, when recovery commenced and the grazing periods were extended a steady increase occurred in her serum level until it was within the normal range.

## Discussion

The results obtained confirm that the use of magnesium manures has a beneficial effect on both pasture composition and cattle blood magnesium levels. They clearly indicate, however, the superiority of calcined magnesite compared with the magnesian limestone. This difference in effect between the two manures suggests that the simultaneous application of calcium antagonises the uptake of magnesium by pasture. The lower calcium content on Plot 3 (N, Mg) again suggests that the soil calcium-magnesium ratio may influence the relationship between calcium and magnesium uptake by the pasture.

These results are in accordance with those of Hunter (1949) who conducted a factorial pot study of the effect of variations in the exchangeable calcium-magnesium ratio upon the growth and

composition of lucerne. Though the calcium-magnesium ratio in the soil had no significant influence upon the weight of the crop produced, it had highly significant effects upon the percentages of calcium and magnesium in the lucerne. As the soil calcium-magnesium ratio increased from 1:4 to 4:1, the magnesium content of the dry matter decreased from 0.58 to 0.25 per cent. in the first planting, and from 0.67 to 0.33 per cent. in the second planting. When the ratio was increased to 32:1 the magnesium values were further reduced to 0.14 and 0.22 per cent. respectively.

The pasture magnesium levels obtained on Plot 3 (N, Mg) gave complete protection to the grazing cows although the hypomagnesaemia encountered on Plot 2 (N) in this case was not as severe as that often met with. It seems that a pasture magnesium level of the order of 0.40 to 0.50 per cent. dry weight of MgO (*i.e.*, approximately double the usual level) will be necessary if hypomagnesaemia is to be controlled with confidence in this manner. Therefore, while the use of magnesian limestone instead of ordinary limestone may be justified as a general step towards the prevention of hypomagnesaemia where the soil has a definite lime requirement, it might be unwise to rely upon it as a specific prophylactic measure. The use of 10 cwt. per acre of calcined magnesite does not, of course, appear to be an economical proposition and further work is necessary to determine the minimum amounts which will be necessary to produce the required effect. It seems likely that this amount will be considerably influenced by the lime status of the soil. On the basis of the present results, pasture which has been recently limed with 2 tons per acre of ground limestone will require at least 10 cwt. of calcined magnesite per acre.

The results presented here are in the nature of a preliminary report. The full significance of these trials cannot yet be assessed since the duration of the effect of the magnesium compounds will obviously have a large influence on the economic possibilities of this form of treatment. Calculations show that for a yield of 6,000 lb. of dry matter per acre, with a magnesium content of 0.50 per cent. MgO, 30 lb. of MgO will be removed each year. On this basis 1 cwt. of calcined magnesite should supply the magnesium requirement for 3 to 4 years, although in practice the amount required will probably be higher because of the effects of leaching.

*Acknowledgment.*—The authors especially wish to thank Mr. B. Roberts for technical assistance.

### References

ALLCROFT, RUTH. (1954). *Vet. Rec.* **66.** 517–22.
ALLCROFT, W. M. (1947). *Vet. J.* **103.** 75–100.
BALCH, C. C., HEAD, M. J., LINE, C., ROOK, J. A. F., & ROWLAND, S. J. (1956). *Proc. Nutr. Soc.* **15.** X.
BARTLETT, S., BROWN, B., FOOT, A. S., ROWLAND, S. J., ALLCROFT, RUTH, & PARR, W. H. (1954). *Brit. Vet. J.* **110.** 3–19.
CUNNINGHAM, I. J. (1934). *N.Z. J. Sci. Technol.* **15.** 414–22.
———. (1936). *Ibid.* **17.** 775–8.
HEAD, M. J., & ROOK, J. A. F. (1955). *Nature.* **176.** 262.
HUNTER, A. S. (1949). *Soil Sci.* **67.** 53–62.
REITH, J. W. S. (1954). *Emp. J. exp. Agric.* **22.** 305–13.
STEWART, J., & REITH, J. W. S. (1956). *J. Comp. Path.* **66.** 1–9.



# Multiple Fractures in a Collie : Osteogenesis Imperfecta

BY
**J. R. HOLMES**
**Department of Veterinary Medicine**
**University of Bristol**
AND
**C. H. G. PRICE**
**Pathology Research Laboratory**
**University of Bristol**

THIS paper describes a case of osteogenesis imperfecta in a 10-week-old Collie bitch.

## History

The affected animal was from the third litter; the first two litters were by the same sire, and this dog was related to the sire of the third litter. A puppy from the second litter may have been similarly diseased.

*First litter*—12 pups were reared from the 13 which were born, with the aid of bottle-feeding. No bone abnormalities developed.

*Second litter*—12 pups born, all of which were raised with the help of bottle-feeding. One bitch (L2. Fig. 1) became lame at 12 weeks, and within 14 days was virtually paralysed. Her appetite remained good, however, but she died a month later. When handled after death the owner stated that "the skeleton appeared completely to disintegrate." Unfortunately, no *post-mortem* was made, but there was clearly some generalised skeletal dystrophy. The remainder of this litter were clinically normal.

*Third litter*—11 puppies were born but only 4 survived for more than 36 hours although the dam had plenty of milk. The cause for this high mortality was not investigated. These 4 pups progressed normally until 3 weeks old, when weaning was commenced by the gradual giving of egg and milk followed by raw meat. All 4 pups then started vomiting and had violent diarrhoea. They deteriorated rapidly and within one week were in a very poor condition. One bitch (L3. Fig. 1), the subject of this communication, now became unable to stand, her legs splaying outwardly and failing to support her body weight. Despite the use of vitamins A and D with calcium and phosphorus supplements—which were given to all the puppies—this animal failed to improve. Two weeks later the diarrhoea and vomiting ceased and feeding recommenced. The puppies improved gradually in condition but remained stunted, and one sold at 10 weeks appeared otherwise normal. The dog and another bitch were retained, and when examined at 4 months of age were in good state.

The affected animal was disinclined to move but tried to walk again at 5 weeks of age; it had great difficulty in rising upon its hind legs and dragged its hind limbs. Later there was a slight improvement,

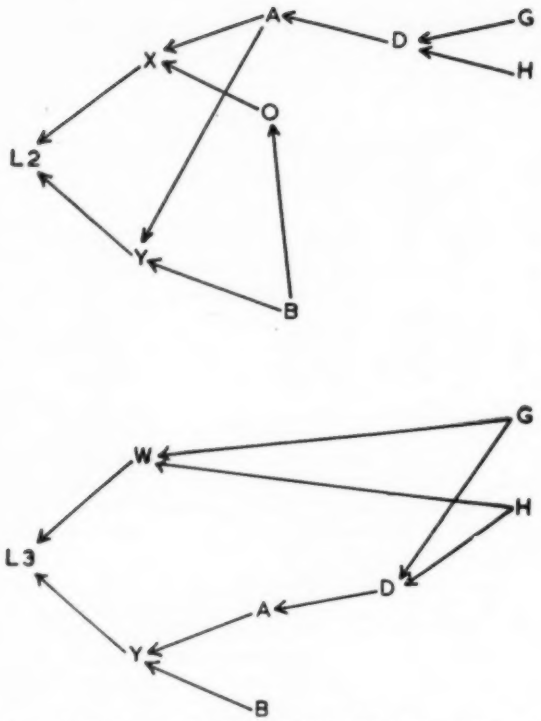



FIG. 1.—Pedigrees of pup L2 (973) and L3 (933), showing common ancestry.

but the unsteady gait persisted despite a good appetite and excellent diet. The animal was seen by one of us (J.R.H.), and examined at 10 weeks of age. Three days previously a fracture of the upper end of the left tibia occurred for no apparent reason, the owner being then ignorant of the presence of any further bony damage. This fracture did not appear to cause pain and manipulation was not resented.

In the case here described there was relatively close in-breeding of these pedigree animals (Fig. 1). Young (1955), however, does not include this bone defect in a paper on inherited diseases in dogs. (Few similar cases have, however, been recorded in the dog, and details of pedigrees are but rarely available).

On examination the sclerotics of the affected pup showed a distinctly blue colour which was more marked than the slight bluish tinge seen in the normal Collies of the same kennel strain. This tinctorial feature in these apparently quite healthy dogs is of interest since Kreeger (1954) has reported similar findings in humans of one family, all of whom had blue sclerotics, and in which 2 of 13 persons had no obvious skeletal defects.

The affected pup was destroyed with nembutal. A blood sample collected at the time of death showed the following values: serum calcium, 15.1 mg. per 100 c.c.; serum inorganic phosphates, 10.0 mg. per 100 c.c.; serum alkaline phosphatase, 9.5 K-A units per 100 c.c.; serum acid phosphatase, 6.7 Bodansky units per 100 c.c.

From these figures, the possibility of hypervitaminosis D was suspected, but the radiological and pathological findings did not support this theory. Moreover, the 3 surviving litter mates had all received similar amounts of vitamin and mineral supplements with no untoward effects.

### Radiological Appearances

Examination of the skeleton *post-mortem* revealed the following fractures:—

1. Left chest wall: Ribs 5, 6, 8 and 9—old fractures. Rib 9—recent fracture. Rib 10—two recent fractures (Fig. 2).

2. Right chest wall: Ribs 4 and 9—recent fractures.

3. Left hind leg: Upper tibial metaphysis. Upper end of fibula shaft—2 fractures.

4. Right hind leg: Upper femoral metaphysis—greenstick fracture. Two metatarsals in metaphyseal region. Os calcis—crack fracture (Fig. 3).

5. Pelvis: Left pubis and left ischium.

The following features were also noted:—

*Skull.* Apart from thinning of the diploe of the anterior parietal and frontal bones, no abnormality was seen. Dentition appeared normal for age.

*Axial skeleton.* Normal.

*Flat bones.* The blade of the scapula appeared poorly formed and, as in the long bones, arrested growth lines were visible. In the pelvis, the left ascending pubic ramus showed an ossification defect at the site of the fracture. (This was subsequently shown to be due to the persistence of an area of primordial cartilage.) The left acetabulum was deformed by osteophytic callus related to the fracture of the left ischium.

*Long Bones.* These showed transverse or spiral fractures, usually sub-metaphyseal in site, with only slight callus formation. Epiphyseal centres of ossification appeared normal for age. There was no axial deformity or marked "necking" as characteristically seen in many human cases of osteogenesis imperfecta. The appearances generally were closely similar to those depicted in canine cases of osteogenesis imperfecta by Calkins *et al.* (1956). The most striking features were the delicacy of the fine primary bone trabeculae, and the poorly formed metaphyseal and diaphyseal corticalis as compared with a normal dog of like age (Figs. 3, 4 and 7). The short tubular bones showed similar changes.

To summarise the radiological findings, there appeared to be deficient formation of both periosteal and endosteal bone, leading to a poorly formed corticalis in long, tubular and flat bones which was most marked in the metaphyseal regions.

### Autopsy Appearances

The coat and skin appeared normal; weight of animal—4.5 kg. The puppy was in fairly good condition; no abnormalities were noted in viscera or soft tissues. The presence of the fractures listed above was confirmed, those in the ribs being associated with areas of localised pleurisy. The fractures were accompanied generally by a small amount of very soft poorly mineralised callus.

Parathyroids (wt.—11 mg.), and kidneys appeared normal (macro- and microscopically).

Apart from the blueness of the sclera, the eyeball showed no gross or microscopic abnormality.

### Histology

Selected tissues were formol fixed and embedded in paraffin. Sections were cut at 6μ and stained by the following methods: H. & E., H. Phloxin and Tartrazine, P.A.S., Toluidine Blue, and by a modified Gomöri's method for argyrophilia.

*Calvarium*

Although anatomical deformity was absent, the bone here showed the greatest deviation from normal that was noted. The usual definition into inner and outer tables was obscured by a honeycomb arrangement. Much of this tissue resembled calcified osteoid rather than true bone.

The periosteum was unduly cellular, and in places oedematous or even myxoid. The soft tissues were richly vascularised with many dilated blood spaces in the medullary cavity.

Individual bone trabeculae showed a peculiar structure (Figs. 8 and 8A). These in longitudinal section were margined by fairly normal lamellar or woven bone, with narrow or absent osteoid seams and well-marked reversion lines. Medial to the latter, and occupying the central core of many trabeculae was ill-formed osteoid of granular appearance, the staining of which suggested that *in vivo* mineralisation had been incomplete. Here also the cells simulated chondrocytes rather than osteocytes, having a rounded or ovoid shape, signs of a capsule, and being deficient in the delicate network of arborescent processes which characterise the cells of normal mature bone. Numerous paired cells also suggested that these cartilage-like cells were still able to proliferate, and much of this tissue was unusually cellular. A few distorted Haversian systems were seen.

*Ribs*

The osteo-chondral junctions showed elongation of the cartilage cell columns merging into the calcified lattice—many of these had 45 to 70 cells per column. Osteoid formation was scanty and many of the delicate primary trabeculae consisted of little more than the attenuated intercolumnar strand of calcified cartilage matrix. Although osteoblasts appeared plentiful and of normal morphology, endosteal bone formation upon these delicate trabeculae was very slight. There were numerous foci of osteoclast activity. Distal to this zone, osteoblast activity increased, but there were numerous islets of unresolved cartilage matrix with many attendant osteoclasts. These islets could be traced well into the bony rib.

At the sites of rib fractures there was often much large-celled cartilage. This was disposed in a continuous transverse plate rather than as a peripheral ring as described by Baker (1946) in a tibia from a human case of osteogenesis imperfecta. Callus where formed showed a marked tendency to differentiate through the intermediate phase of cartilage to bone, or to tissue of a mixed chondrosteoid nature. This cartilage in callus showed a focal granular degeneration leading to the formation of amorphous eosinophilic material of the type described by Follis (1952). This in some places was accompanied by numerous giant cells of osteoclast type (Fig. 10). (Similar degenerative products from cartilage have been seen by one of us (C.H.G.P.) in other lesions where calcified cartilage has been undergoing destruction, *e.g.*, osteo-arthritis, neoplastic invasion, etc. This material is not argyrophilic, but stains moderately well with the P.A.S. technique. It is usually orthochromatic with thiazine dyes and when stained with the phloxin-tartrazine modification of the trichrome method, it is either deeply phloxinophilic, or else assumes a metachromatic mahogany brown hue).

*Flat bones. Pelvis.*

Near the fracture site in the ascending ramus of the ischium was an extensive honeycomb of internal chondrosteoid callus with a broad plate of cartilage of sufficient size to suggest that it was at least contributory to the fracture.

*Long Bones and Tubular Bones*

The growth cartilages showed features similar to those of the ribs. The periosteum overlying the metaphyses was thickened and cellular. Here the cortex was formed of open-textured thin trabeculae of lamellar bone separated by loose vascular connective tissue and cellular marrow (Fig. 5). There was much unresolved cartilage matrix (Fig. 9) which, together with the indifferent ossification of the corticalis, no doubt produced an area of relative weakness and hence the typical submetaphyseal site of the multiple fractures. A few ill-formed Haversian systems were present.

Medial to the swollen cellular periosteum the diaphyseal cortex consisted of parallel bars of new woven bone rather widely separated by loose fibro-areolar tissue and margined by active osteoblasts (Fig. 6). The corticalis here was better formed than at the extremities. However, for a total femur length of 93 mm. the maximum thickness of the diaphyseal cortex was about 1.2 mm. The medulla contained normal fatty and cellular marrow.

*Callus*

During the short life of this animal only a small amount of callus was formed. Although nowhere exuberant, it showed considerable cellular diversion, which apart from the absence of atypism and mitoses might almost invite the consideration of a diagnosis of sarcoma. On a much reduced scale this callus resembled that described in humans by Baker (1946), Strach (1953) and others, even to the frequency of chondroid areas.

To summarise the histological appearances, the main features were:—

1. Deficient endosteal ossification, especially of the long bones.

2. Reduction in periosteal bone formation.

3. An unusual pattern in intra-membranous bone with cells morphologically akin to chondrocytes. These abnormal cells also appeared in callus.

4. The persistence of much unresolved cartilage matrix.

5. General absence of lamellar and Haversian bone.

### Biochemical Observations

In view of the observations of Baxter *et al.* (1953) the possibility of copper deficiency in this puppy was considered, although the skin and coat were normal and anaemia was absent. Matched specimens of long bones were therefore prepared for analysis as follows: the major long bones and those of a normal puppy of like age (BTR/973) were freed of all soft tissue and cartilage by thorough scraping, and then washed for 2 days in running tap water to remove the formalin fixative. The diaphyses were then cut longitudinally and all marrow and cancellous bone was removed. The bones were dehydrated in ethanol and ether, dried for 12 hours at 56°, and then pulverised. The lower halves were used. The upper halves of these bones after similar treatment are shown radiographically in Fig. 4.

| | Dog 933 (L. 3) | | Dog 973 (Normal) | |
|---|---|---|---|---|
| | Tibia | Humerus | Tibia | Humerus |
| | *Percentage* | | *Percentage* | |
| Moisture. | 6.7 | 5.5 | 9.4 | 5.1 |
| Copper: parts per M. of dried weight. | 52.[illegible] | 45.0 | 45.0 | 36.0 |

The powdered bone samples were then dried for a further two hours at 110°, and pulverised to pass a 100-mesh screen. Flotation on a chloroform-bromoform mixture (1.8 g. per c.c.) was then carried out, and aliquots of the heavy fraction were washed with chloroform and dried to constant weight; 15 to 20 mg. samples were ashed.

| | Dog 933 (L. 3) | | Dog 973 (Normal) | |
|---|---|---|---|---|
| | Tibia | Humerus | Tibia | Humerus |
| | *Percentage* | | *Percentage* | |
| Dry Ash. (Means of 3 samples.) | 67.0 | 69.3 | 65.4 | 67.4 |
| *Total carbohydrate. (Means of 3 samples.) | 0.32 | 0.30 | 0.23 | 0.22 |

* Estimated against a galactose-mannose standard 1:1.

These results clearly eliminated copper deficiency as the cause of the bone changes. Since the main component of the dry ash is the microcrystalline bone salt, it was concluded that there was no defect in mineralisation of the bone when formed. It was further concluded that these limited investigations did not indicate any quantitative differences between the normal and abnormal bones.

### Discussion

The syndrome here described of multiple fractures in a young animal may appear in the following conditions:—

1. Neonatal rickets (Avitaminotic).
2. Congenital renal rickets.
3. Dyschondroplasia (Ollier's disease type).
4. Inanition.
5. Copper deficiency.
6. Osteogenesis imperfecta.

Consideration of the information available about this puppy, although incomplete, suggested that the last named condition was the most probable diagnosis. Osteogenesis imperfecta has been described in a number of mammalian species: cats (Schnelle, 1950, and Riser, 1956); dogs (Schnelle, 1950; Calkins *et al.*, 1956), and the condition is of course well-known in human pathology. We have also examined bones from lambs that had sustained multiple fractures, and consider that the disease of that species known as "the cripples" is probably of a similar nature and akin to osteogenesis imperfecta.

The bones of the present animal conform to that variant of the human disease known as the long slender bone type—a form which seems to be less severe than the short thick bone type more commonly seen in man. Examples of both forms of the human disease are depicted by Fairbank (1948) and it is amongst the milder cases of the former variant that survivors beyond adolescence may appear. The view advanced by Follis (1952) that the disease is in fact a generalised connective tissue dystrophy has much to support it although, nevertheless, it is likely to vary in degree of severity, and in milder examples show most dramatically by virtue of the bone defects which result from the underlying dysgenesis of the organic skeletal framework.

In the present case, as in the animals described by Calkins *et al.*, the possibility of copper deficiency was considered but was refuted by the analytical results. The slightly raised figure for parathyroid tissue (2.4 mg. per kilo—as compared with 1.19 ± 0.48 mg. per kilo reported by Platt (1951) in 7 normal dogs) might suggest that there had been some hyperparathyroidism in this puppy. However, no further evidence was found in support of this possibility.

*Acknowledgments.*—The authors wish to record their thanks to Mr. E. G. Whittle, B.SC., F.R.I.C., for carrying out the copper estimations on the bone specimens examined. The further analytical procedures carried out were kindly performed by Dr. M. V. Stack, PH.D. The reproduction of radiographs and microphotographs are the work of Mr. J. E. Hancock, whose assistance in this respect was invaluable.

#### References

BAKER, S. L. (1946). *J. Path. Bact.* **58.** 609.
BAXTER, J. H., & VAN WYK, J. H. (1953). *Bull. Johns Hopkins Hosp.* **93.** 1.

(*Concluded at foot of col. 1 overleaf*)

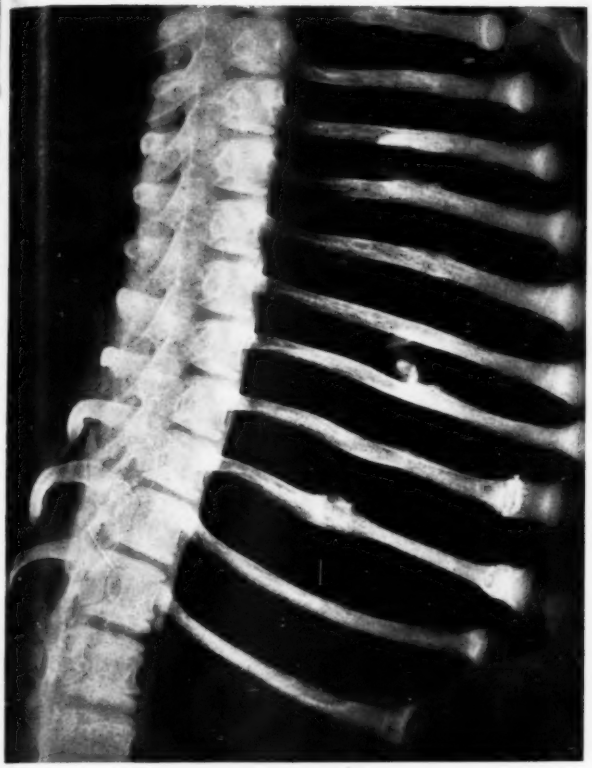


FIG. 2.

FIG. 3.

A. B. C. D.

FIG. 4.

FIG. 2.—Radiograph of left ribs, showing multiple greenstick fractures.

FIG. 3.—Radiograph of right hind leg; fractures of femur, os calcis and metatarsal are visible.

FIG. 4.—Radiographs of upper end of long bone shafts after removal of soft tissues and medullary contents. A.—Humerus of abnormal animal (933); B.—Humerus of normal animal (973); C.—Tibia of abnormal animal (933); D.—Tibia of normal animal (973). Note poorly formed corticalis in specimens A. and C.

FIG. 5.—Photomicrograph. (Haematoxylin, Phloxin & Tartrazine, x 65.) The field shows practically the full width of the cortex of the humerus metaphysis. Very little new bone has been laid down upon the delicate trabeculae formed in the lateral part of the growth cartilage.

FIG. 6.—Photomicrograph. (H., Ph. & T., x 65.) This field shows the full width of the mid-diaphyseal cortex of the humerus. A similar structure was observed in other long bones—*e.g.*, femur, as shown in FIG. 7.

FIG. 7.—Radiograph. Femur, central diaphyseal cortex. (Enlarged, x 4.)

FIG. 8A.—Photomicrograph. (H. Ph. & T., x 270, polars parallel.) Bone trabecula from calvarium. Note resemblance of bone cells to chondrocytes.

FIG. 8B.—Same field as FIG. 8A—Polars crossed. The trabecula is margined by fairly well formed woven and lamellar bone; but the central area is poorly ossified.

FIG. 9.—Photomicrograph (Toluidine Blue, x 40.) Humerus metaphysis, showing extensive residual cartilage matrix.

FIG. 10.—Photomicrograph. (Toluidine Blue, x 125.) Metatarsal Granular degeneration of matrix derived from metaplastic cartilage in callus of fracture shown in FIG. 3.

FIG. 7.

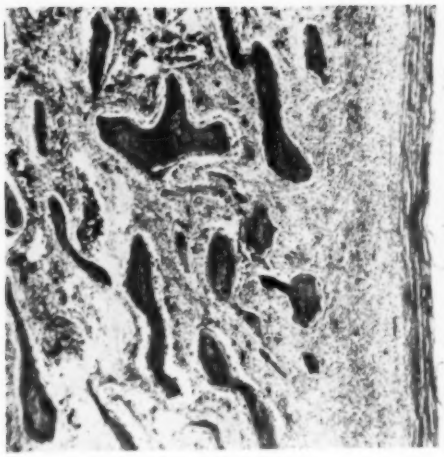


FIG 5.

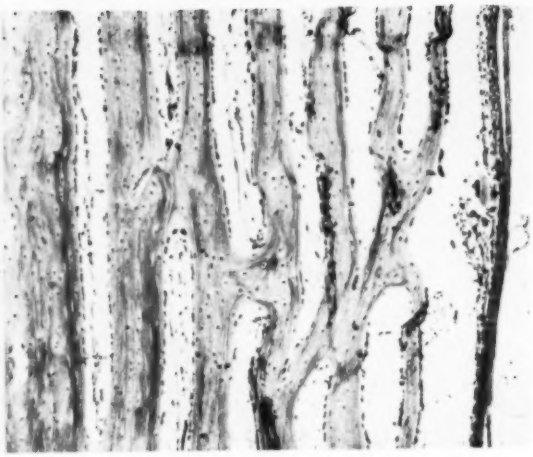


FIG. 6.

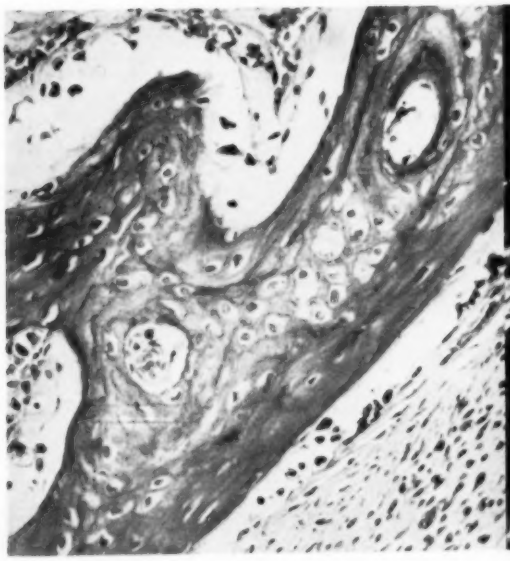


FIG. 8A.

FIG. 8B

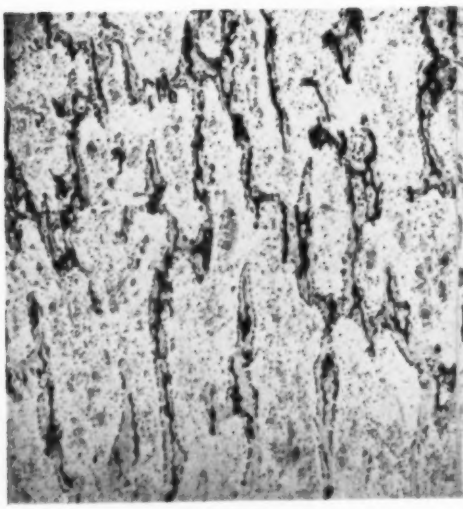


FIG. 9.

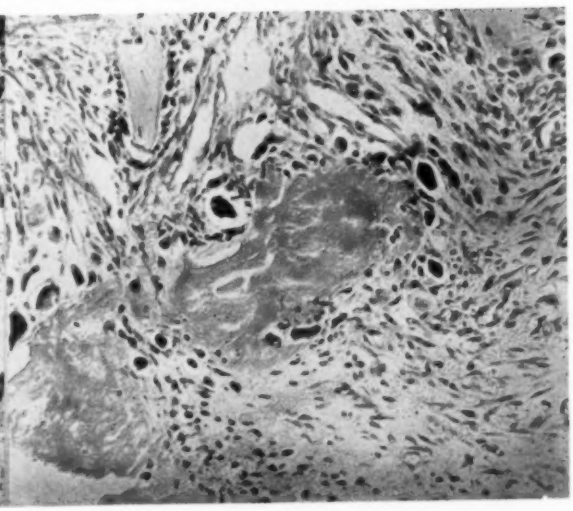


FIG. 10.

# An Outbreak of Duck Coccidiosis in Britain

BY

**S. F. M. DAVIES**

**Ministry of Agriculture, Central Veterinary Laboratory, Weybridge, Surrey**

*SUMMARY.—An outbreak of duck coccidiosis in Britain is described. Oocysts of Eimeria and Tyzzeria were recovered from field pens and infections with these parasites were reproduced in the laboratory, but were not sufficiently severe to produce disease.*

## Introduction

COCCIDIOSIS in ducks has been reported from various countries on a number of occasions (Becker, 1934; Allen, 1936; Christiansen & Madsen, 1948; Scholtyseck, 1955), but there have been no published reports of duck coccidiosis in Britain despite the existence of a large intensive duck-rearing industry with its constantly changing population of young susceptible ducklings. The following is an account of a disease in ducks which was found to be due to coccidial parasites.

## History of the Disease

During the past few years outbreaks of an acute disease among ducklings have occurred on a duck farm in Hertfordshire and lesions suggestive of a severe fatal form of intestinal coccidiosis were found in ducklings received for *post-mortem* examination at the Weybridge Laboratory. After the 1955 season, in an effort to avoid further losses, the rearing pens on the farm had been moved to fresh ground well away from the previous site. During the spring of the following year there were no signs of disease but with the onset of wet weather in July acute disease was again encountered and losses continued during the remainder of the summer and into the autumn.

## The Pattern of the Outbreaks

Ducklings were hatched in incubators from eggs supplied by the breeding stock of the farm. They were maintained for the first 3 weeks of life in wire-floored brooders and were then transferred to outdoor pens on grass where they remained until they were killed for marketing at approximately 8 weeks of age. First signs of disease in affected groups were noted on the fourth day after the batch had been transferred to the grass pens with deaths reaching a peak on the fifth and sixth days. Thereafter the rate of mortality declined and the majority of the ducklings recovered but many were not fattened successfully.

### *Post-mortem* Appearance

An acute haemorrhagic type of intestinal coccidiosis was seen at *post-mortem* examination and stained smears of intestinal scrapings revealed numerous merozoites.

## Isolation of the Parasites

Initial attempts to isolate the parasites from dead or culled birds were not successful, very few coccidial oocysts being recovered from the intestines. Samples of droppings and surface soil from two field pens in which deaths had occurred were therefore collected and were found to contain oocysts referable to two types:—

1. Oocysts of the genus Isospora measuring 17.5$\mu$ x 15.5$\mu$, most of which had sporulated; some had reached the sporont stage of development while others were unsporulated.

2. Unsporulated oocysts measuring 18$\mu$ x 13$\mu$ with a distinct ring-shaped projection at the narrower end of the oocyst similar to that described by Scholtyseck (1955).

A few small oocysts measuring 12$\mu$ x 10$\mu$ also were found.

A suspension of the oocysts was placed in a shallow dish and was left at room temperature to allow the process of sporulation to continue. After 3 days the majority of the oocysts had sporulated. Oocysts of the second type were now identified as oocysts of the genus Eimeria, with 4 sporocysts each containing 2 sporozoites. A few of the small oocysts had sporulated and appeared to belong to the genus Tyzzeria described by Allen (1936), having 8 free sporozoites inside the oocyst wall.

## Experimental Infections

Three 10-day-old ducklings which had been kept in isolation were infected with 2 ml. of the suspension of mixed oocysts and placed in wire-floored cages. Oocysts were first detected in their droppings on the fifth day after infection. They were mainly oocysts of Eimeria but a few oocysts of Tyzzeria also were found. During the fifth and sixth days after infection numerous oocysts were produced and a second suspension was prepared for further use. The numbers of oocysts declined until by the ninth day few could be detected. At no time were the oocysts of Isospora observed and although a similar group of ducklings was inoculated with the original suspension and oocysts of both Eimeria and Tyzzeria were recovered after 6 days no oocysts of Isospora were detected. It appeared therefore that these oocysts were of a species which was not parasitic in the ducklings. It is possible that they may have come from the wild birds which frequented the field pens.

Symptoms of disease were not seen in either of the groups of ducklings but this was thought to be due

**References.**—*Concluded.*

CALKINS, E., KAHN, D., & DINER, W. C. (1956). *Ann. New York Acad. Sci.* **64.** 410.
FAIRBANK, H. A. T. (1948). *J. Bone & Joint Surg.* **30B.** 164.
FOLLIS, R. H., Jnr. (1952). *J. Pediat.* **41.** 713.
KREEGER, L. C. (1954). *Brit. Med. J.* **4886.** 498.
PLATT, H. (1951). *J. comp. Path.* **61.** 188.
RISER, W. A. (1956). *J. Amer vet. med. Ass.* **128.** 609.
SCHNELLE, G. B. (1950). "Radiology in Small Animal Practice. A text on applied radiography and diagnosis." 2nd ed. North Am. Veterinarian, Evantson, Ill.
STRACH, E. H. (1953). *J. Bone & Joint Surg.* **35B.** 417.
YOUNG, G. B. (1955). *Vet. Rec.* **67.** 15.

to the small numbers of oocysts which had been inoculated.

The second suspension of sporulated oocysts was found to contain predominantly oocysts of Eimeria and it was used to infect a further group of 12 ducklings, each of which received approximately 25,000 sporulated oocysts. Oocyst production started after 93 hours but symptoms of disease were not observed nor did deaths occur. Suspensions of oocysts prepared from these ducklings again showed a predominance of those referable to Eimeria and furthermore it was noted that most of the oocysts of the Tyzzeria species were not sporulating successfully under the usual laboratory conditions.

Subsequent observations have shown that inoculations of up to 200,000 sporulated oocysts of Eimeria do not produce symptoms or deaths, but where repeated inoculations of a suspension of mixed oocysts have been made the gradual build-up of oocysts of Tyzzeria has produced a slight intestinal coccidiosis from which merozoites have been detected in stained smears.

### Discussion

In this series of observations a high level of infection with oocysts of the Tyzzeria species has not been achieved but from a comparison of the symptoms and *post-mortem* findings with those described by Allen (1936) and from the negative results obtained with the Eimeria species it appears that the Tyzzeria infection was responsible for the field losses. Cases of acute coccidiosis in ducklings have since been encountered among specimens submitted to the laboratory from a duck farm in Norfolk as suspected fowl pest casualities. In these ducklings an acute widespread intestinal coccidiosis was found extending from the duodenum to the rectum and numerous oocysts of Tyzzeria were recovered from the intestinal contents. Suspensions of these oocysts were put to sporulate under normal laboratory conditions but again so few oocysts sporulated successfully that it was not possible to reproduce clinical disease.

Difficulties in obtaining satisfactory sporulation of other Tyzzeria species have been reported by Dougherty (1953), but Allen (1936) was able to reproduce clinical coccidiosis in domestic ducks with *Tyzzeria perniciosa*. The numbers of oocysts inoculated were not recorded.

Further attempts to obtain pure suspensions of the two types of oocyst are being made and a precise identification of the species of parasite should then be possible.

*Acknowledgments.*—My thanks are due to my colleagues, Mr. J. D. Blaxland and Mr. F. D. Asplin, for bringing these outbreaks to my notice.

### References

ALLEN, E. A. (1936). *Arch. Protistenk.* **87.** 262.
BECKER, E. R. (1934). "Coccidia and Coccidiosis of Domestic, Game and Laboratory Animals and of Man." Ames, Iowa: Collegiate Press, Inc. p. 42.
CHRISTIANSEN, M., & MADSEN, H. (1948). *Danish Rev. Game Biol.* **1.** 61.
DOUGHERTY, E. (1953). *Proc. 90th Ann. Meet. A.V.M.A. Toronto.* p. 362.
SCHOLTYSECK, E. (1955). *Arch. Protistenk.* **100.** 431.

# Current Literature

## ABSTRACTS

**Ringworm in Wild Animals in Southwestern Georgia.** MENGES, R. W., LOVE, G. J., SMITH, W. W., & GEORG, L. K. (1957). *Am. J. vet. Res.* **18.** 672–7.

When cultures were prepared from hairs from 1,142 wild animals of 21 different species, 88 (7·2 per cent.) yielded *Microsporum gypseum* or *Trichophyton mentagrophytes*. All 88 animals had appeared to be clinically normal, and none of the hairs showed fluorescence under Wood's glass. *M. gypseum* was also isolated from 16 (26 per cent.) of 62 soil samples taken from the same areas. The authors conclude that rodents constitute a likely source of human infection.

**Studies on Drug Toxicity in Chicks. 4. The Influence of Various Levels of Nitrofurazone on Growth and Development of Chicks.** NEWBERNE, P. M., & MCEUEN, G. L. (1957). *Poult. Sci.* **36.** 739–43.

Chicks receiving 0·0125 or 0·025 per cent. of nitrofurazone (NFZ) in the food for the first 8 weeks of life showed no significant depression of growth rate and no histological evidence of toxicity. Levels of 0·05 per cent. or more were found to be toxic, the affected chicks showing depression of growth, polyneuritis, curled-toe paralysis, renal degeneration and ossified nodules in the lungs.

**The Value of a Grass Sward for Breeding Hens.** BLACK, D. J. G., MORRIS, T. R., & PALGRAVE, J. A. (1957). *Poult. Sci.* **36.** 780–8.

The performance of birds kept on an old-established grass sward was compared with that of others on bare earth. Six different rations were used. Access to grass did not result in any saving in the amount of food consumed. There was a marked increase in the vitamin A, riboflavin and pigment content of the eggs, but this was not associated with any increase in egg production, fertility or hatchability. The hens receiving rations with the higher levels of white fish meal showed a depressed hatchability, suggesting that it is advisable to feed a mixture of protein supplements so that no one supplement forms more than a few per cent. of the total diet.

**The Effect of 2, 4, 5-T Brush Spray on Turkeys.** ROBERTS, R. E., & ROGERS, B. J. (1957). *Poult. Sci.* **36.** 703–5.

Turkeys were penned on a lucerne and bluegrass pasture immediately after it had been sprayed, at the usual rate of 1·6 lb. per acre, with the hormone weedkiller 2, 4, 5-T. Eleven days later they were transferred to a similar pasture sprayed 3 days previously, and on which the foliage was well wilted. No ill effects were observed in either trial.

The inclusion, for 11 days, of either 0·25 per cent. of the herbicide or 10 per cent. of sprayed lucerne in the food of intensively kept turkeys also failed to cause any appreciable effect on the appetite or the rate of growth of the birds.

**Observations on Experimental Bovine *Vibrio fetus* Infection.** BLOBEL, H., SIMON, J., & MCNUTT, S. H. (1957). *Am. J. vet. Res.* **18.** 579–83.

The authors were able to infect 10 of 14 heifers by vaginal or intrauterine installation of cultures of *Vibrio fetus*. The infected heifers tended to return to service, showing irregular, prolonged oestral cycles, but no abortions occurred. The vaginal mucus agglutination test was a valuable diagnostic aid provided that samples were not collected at or about the time of oestrus. Positive titres were first given 4 to 10 weeks after infection and persisted for about 4 to 12 months. Blood serum agglutination tests were of doubtful value, as were conjunctival and intradermal tests.

**Isolation of *Vibrio fetus* from Bulls.** PLASTRIDGE, W. N., WALKER, E. C., WILLIAMS, L. F., STULA, E. F., & KIGGINS, E. M. (1957). *Amer. J. vet. Res.* **18.** 575–8.

Bacteriological examination of semen and sheath washings from 149 bulls in 4 A.I. centres in New England, U.S.A., showed that 41 per cent. were carriers of *Vibrio fetus*. The details and limitations of the bacteriological techniques are discussed.

**An Abnormality of the Bovine Penis.** ASHDOWN, R. R. (1957). *Am. J. vet Res.* **18.** 543–5.

The penis of a castrated ox showed an abnormally well-developed urethral process which was adherent to the sheath. The apex of the penis was bifid. This finding is discussed in relation to the evolutionary development of the penis of various ruminants.

E. A. G.

**New Developments in Animal Nutrition.** CHAPPEL, C. F. (1957). *Vet. Med.* **52.** 453.

The most interesting developments in animal nutrition during the past year are covered. It has been demonstrated that the baby pig and calf do not secrete adequate amounts of proteolytic and amolytic enzymes to digest feed grade carbohydrates efficiently, particularly during the first 3 to 5 weeks of age. The addition of pepsin appears to be beneficial if pigs are weaned at about 3 weeks of age, or earlier, and if they are dependent upon the consumption of a dry starter meal. Research has indicated that management to prevent sows from getting too fat will increase litter size, and this was effected at one research centre if the sows were self fed a high fibre, low-energy ration, which contained an adequate level of protein and was highly fortified with all the other essential nutrients.

The greatest thing that has happened in the feeding of beef cattle during the past several years has been the discovery that the feeding of diethylstilboestrol stimulated gains and improved feed efficiency. A summary of 22 experiments indicated that feeding diethylstilboestrol increased rate of gain by about 16 per cent. and improved feed efficiency by about 12 per cent. This summary was for all classes of cattle fed many kinds of rations. When summarized, data collected from many experimental stations indicate that the feeding of approximately 75 mg. of a broad spectrum antibiotic stimulated growth rate approximately 6 per cent. and decreased the amount of feed required to produce a pound of gain by approximately 4 per cent. Some experiments showed that the combination of diethylstilboestrol and the broad spectrum antibiotics was superior to feeding diethylstilboestrol alone, but almost an equal number of experiments indicated no improvement or inferior gains.

Experiments have been conducted on the use of diethylstilboestrol for breeding cattle. Dairy cows were fed 1 mg. of diethylstilboestrol per 100 lb. of bodyweight prior to breeding, during gestation, and during the following lactation period. Identical twins were used in these experiments and the treated twins performed equally as well as the control twins. In another experiment heifers fed 10 mg. of stilboestrol gained 20 per cent. faster and converted their food 18 per cent. more efficiently than did the control heifers. After being kept on experimental diets containing varying levels of diethylstilboestrol for about 70 days heifers were mated, and later slaughtered and the foetuses recovered. It was apparent that 10 or 20 mg. daily did not adversely affect reproduction, but that 100 mg. daily (ten times the recommended level) apparently interfered with conception.

Raising the energy level of calf milk replacers improves them tremendously, and they should contain about 10 per cent. animal fat, 20 per cent. protein and a maximum of 2 or 3 per cent. fibre. In addition they should contain from 12 to 20 mg. of antibiotic per pound of complete feed. The feeding of 2 mg. diethylstilboestrol per head daily increased the gains in wether lambs by approximately 30 per cent., and the addition of 10 mg. of chlortetracycline to the diet of ewe lambs increased daily gains by about 18 per cent. Significantly greater gains were obtained daily from suckling twin lambs fed creep rations containing sugar, antibiotic, extra vitamins and minerals, as compared to a creep ration made up essentially from normal ingredients. In addition this super creep feed improved the carcase quality.

There has been a marked improvement in broiler rations, and in many instances production costs have decreased as much as 10 per cent. Much of this improvement has resulted from the application of the calorie-protein ratio concept in formulating high-energy foods. The proper level of protein and energy in a broiler ration is about 42 calories of productive energy for each per cent. of protein in the ration. The use of dehulled soya bean meal, substituting low fibre grains for higher fibre grains, and the addition of animal fats has made this high-energy ration possible and practical. Experimental evidence indicates that the methionine requirement, expressed as a percentage of the diet, is increased as the productive energy content of the diet is raised. Recently a similar relationship was also found with lysine. Considerable research has been conducted on the addition of high levels of antibiotics (50 to 200 gm. per ton) to rations for laying hens. Some tests have indicated that the addition of certain antibiotics may increase egg production and improve feed efficiency.

In the past few years several feeding tests have indicated that the pelleting of rations increased their feeding value. Recent research suggests that there may be some actual nutritional or chemical change that takes place when feeds are pelleted which increases their nutritional value.

J. O. L. K.

XUM

# A Hide of Land and a Cow

BY
**R. H. A. MERLEN**
**Royal Veterinary College, London**

NOSTALGIC backward glances, and a kind of historical, wishful thinking, have combined over the years to give the impression that, by and large, the medieval peasantry were a jolly, red-faced crowd, living sturdy independent lives on their small holdings and varying the healthy, open-air, daily round and common task with bouts of minstrelsy, horseplay, and heavy drinking on the numerous high-days and holidays. Illustrations in Victorian history books have added conviction to this belief by, now and then, portraying a peasant or two rubber-necking at one of the Great Events of Our Island's Story, and showing them, while properly conscious of their social inferiority, well turned-out in Lincoln Green, well-fed, and yeoman-like.

In reality very little of this seems to have been so, and an examination of the contemporary chronicles, conducted with that certain insight into agricultural matters which a veterinary education alone can give, reveals that between politics and catastrophes of a natural kind, kings and cabbages, death and damnation, life down on the farm in the Dark Ages was a straightforward hell-on-earth.

From as far back as the beginning of the 6th century A.D. the stark and laconic annals of those times record again and again wholesale outbreaks of fatal epizootics among farmstock and the decimation of the human population by famine and disease. Famine followed naturally in the wake of an outbreak since, with the wiping out of the oxen, there was no longer anything left to pull the ploughs, although, as a desperate measure, the women and children were sometimes put in the shafts to see what they could do.

In 810 the Emperor Charlemagne, returned from an expedition to the Elbe, brought back a new and extraordinary fatal " murrain " of cattle and superimposed it on the indigenous disease pattern obtaining in Western Europe. It seems quite likely that this was introduced into England about a century later, perhaps by the Norsemen, since the terse, two-line entry in the Anglo-Saxon chronicle for the year 986 records " . . . and her com aerest se myccla yrfcwalm (*i.e.* murrain) on Angel cyn."

All through Norman times due, perhaps, to fresh waves of infection being brought into the country by the constant cross-channel comings and goings, the build-up of disease was calamitous. 1086, 1103, and 1131 were all years of great epizootics accompanied by privations and suffering that had no previous parallel and which appear to have set up a vicious circle of murrain, famine, lowered resistance through famine, and fresh outbreaks of disease. The foundation of modern England under the Normans seems to have been accompanied by the same shocking privations and loss of life as marked the inauguration of the Soviet regime eight centuries later.

Exactly what these animal plagues of the Dark Ages were, whether rinderpest, anthrax, or foot-and-mouth disease even, is very difficult to say, partly because the symptoms accompanying an outbreak are not recorded and partly because the species of animals involved in an epizootic are sometimes not what would be expected. For example the " orfcwealm " of 1131 occurred simultaneously in pigs and cattle, and after they had been wiped out, " swulten tha henne fugeles," the chickens died *en masse*. This reads oddly from the modern point of view because rinderpest is not now a fatal disease of pigs and does not occur in poultry; and while anthrax might have caused widespread havoc among the different species it is difficult to imagine it sweeping the country with the dramatic speed of a plague. It is, of course, possible that outbreaks of swine fever and fowl pest might have been running their courses concurrently with an epidemic of rinderpest, but the coincidence is a little strange.

Another most interesting fact, and one that continued to be associated with outbreaks of animal plagues until well into the 15th century is that epizootics among the brute creation were often accompanied by outbreaks of plague among human beings. This is not a case of superstitious signs and wonders and medieval God-wottery with which the chronicles abound, but a simple matter of fact; cattle died on the one hand and men on the other. Here again it is possible that bubonic plague may have been running its course alongside some animal scourge; but failing this explanation it seems reasonable to assume that the disease was one common to both man and animals. Of the diseases that affect both parts of creation, TB., glanders, and rabies can be ruled out as running too chronic a course, or as having too peculiar a method of spread, to be confused with a plague. This, again, leaves only anthrax, which, admittedly, must have been responsible for a fair number of deaths in the days before its nature was understood. But fatal though anthrax can be, it does not spread with the rapidity of a plague.

The question then arises as to whether, even so late as the middle of the 15th century, there were other diseases which medieval man, living cheek by jowl with his stock, might have shared with farm animals. Is there a possibility that " plague " might still have been common to both? Was there still one " pox " fatal alike to man and animals? There are grounds for thinking this might have been so. The Pasteurella group of organisms to which *B. pestis* and the bacillus responsible for the haemorrhagic septicaemia of animals both belong, have sufficient cultural and morphological characteristics to suggest a close relationship of comparatively recent date. The serological affinities of cow pox and small pox are too well-known to need discussion here. It seems possible that the change in man's habits, his withdrawing more and more away from his animals, may have led to a splitting up of the old root bacterial families, and

(*Concluded at foot of col.* 1, *page* 1055)

# In Parliament

## Exports of Live Cattle

MR. JOHN EDEN (October 31st) asked the Minister of Agriculture, Fisheries and Food to what extent old cattle have been shipped to Western European ports during recent weeks; what investigations he has carried out to ensure that cruelty no longer exists in connexion with this traffic; and whether he will now take some additional action in this matter, either by imposing a minimum export price or by some other means, so as to ensure that the trade is beyond criticism.

MR. BURDEN asked the Minister of Agriculture, Fisheries and Food (1) what has been the situation with regard to the export of aged cattle to the Continent during the past three months; and whether, in the light of this experience, he will now reconsider the desirability of introducing some form of filter price with regard to the export of such cattle;

(2) Whether he is now satisfied that all inhumanity has been effectively eliminated from the export trade in cattle to the Continent as in the case of the export of horses; and what further action he proposes to take in the matter.

MR. AMORY: My veterinary officers keep a very close watch on this trade and no animal is allowed to be exported unless it is considered fit to travel and has been fully rested. Exports are permitted only to countries whose Governments have undertaken to comply with the conditions announced in my statement to the House on July 1st. These are at present Holland, Western Germany, and France.

These arrangements appear to be working well and should have removed any reasonable grounds for complaint. I do not consider that any further action is called for, but I shall continue to watch the situation.

## Foot-and-Mouth Disease

MR. HURD (October 31st) asked the Minister of Agriculture, Fisheries and Food the total number of outbreaks of foot-and-mouth disease this year; how many of these have been traced to infection of South American origin; and what further measures the Argentine authorities have been asked to take so as to make more effective the inspection and quarantine of cattle which are destined for shipment here as chilled or frozen beef.

MR. AMORY: There have been 116 confirmed outbreaks of foot-and-mouth disease in England and Wales this year, including 29 classified as primaries. Of the primaries, 17 are attributed to meat from South America; these gave rise to 79 secondary outbreaks.

My veterinary officers have discussed with the Argentine authorities the possibility of keeping animals in quarantine for a period before slaughter but this was not found to be practicable. The Argentine authorities are very co-operative and every effort is made to reduce as far as possible the risk of bringing in foot-and-mouth disease. No system of inspection, however, can be relied upon to eliminate it completely.

MR. HURD: Is my right hon. Friend satisfied that this matter is really being pursued actively by the Argentine authorities? Are they not rather taking it for granted that we must have their chilled beef and that, therefore, we must take the risks of getting foot-and-mouth with it? Will not he have another full inquiry made as to what measures could be taken to safeguard our herds and flocks rather better?

MR. AMORY: I do not think the Argentine authorities are complacent about this matter. We have had to acknowledge that there are very great practical difficulties in establishing quarantine arrangements over there. Indeed, if it were done it might even increase the risk of incubation of the disease during the period of quarantine. The Argentine authorities have set up a permanent commission for the eradication of foot-and-mouth disease, but, of course, that is a long-term effort.

## Radioactive Fall-out (Livestock)

MR. PEART (October 31st) asked the Minister of Agriculture, Fisheries and Food if he will make a statement on the restriction of milk production in Cumberland and the possible effects of radioactivity on animal husbandry.

SIR I. FRASER asked the Minister of Agriculture, Fisheries and Food if he will make a statement as to the short-term or long-term effect upon animals of grazing upon pastures subject to the Windscale fall-out; and what markets are still affected.

MR. AMORY: Following the mishap at Windscale, milk produced in an area of Cumberland and Lancashire covering about 200 square miles was found to contain the radio-isotope Iodine 131 in amounts which it was thought might involve some risk to young children living wholly on milk. About 1,000 farms were affected. Distribution of the milk was stopped as soon as this was discovered and steps were taken for its safe disposal. Fresh supplies from out-

---

**A Hide of Land and a Cow.**—*Concluded.*

resulted in one half of the Pasteurella group striking out a line of its own, taking on a mode of life associated with a vector and following man into his home, while the pox virus became specialised for different species. The adaptability and mutability of viruses and bacilli when confronted with adverse conditions and problems associated with survival are well known; the billions of generations which have come into existence over the centuries would have allowed the most far-reaching changes to have taken place.

If this is so, then the study of the writings of the ancients, from being a mere arty-crafty pastime becomes something which is capable of making a very material contribution to an understanding of the nature and capabilities of micro-organisms. Taken in conjunction with the recently mooted Boshyan theory of the mutability of viruses and bacteria it is well able to give another and vitally important dimension to bacteriological studies.

side the area were brought in by the Milk Marketing Board.

Radioactivity in the eastern part of the area has now declined to very low levels, and I am advised by the Medical Research Council that the milk is safe. From to-day, therefore, I have authorised the Milk Marketing Board to resume distribution from nearly half the farms originally affected. The remainder will be freed as soon as the Medical Research Council can assure me that there is no danger. I am advised by the Agricultural Research Council that the health of farm animals grazing in the area should not be affected now or in the future. No restrictions have, therefore, been imposed on the movement of stock. Those purchasing cows in milk from the area have been advised that the milk will be safe for all purposes within twenty-four hours of their being moved on to fresh pasture.

MR. ALLAUN (October 31st) asked the Prime Minister if he will state the increase in strontium 90 found in the bones of animals in Great Britain and in other effects of nuclear test explosions since the Government's statements in June and July.

THE PRIME MINISTER: Measurements of the extent to which soil, herbage, farm animals, and milk and other foodstuffs, have been contaminated by radioactive fall-out are made regularly at a number of localities in Great Britain. The figures are made available from time to time and the latest are contained in a further report by the Atomic Energy Research Establishment, Harwell, entitled "Radiostrontium in Soil, Grass, Milk, and Bone in the United Kingdom." A copy has been placed in the Library. This report relates to the year 1956 but contains some provisional figures for 1957.

To ensure that the fullest possible precautions are taken, some reorganisation of the machinery for monitoring fall-out, and of the responsibility for its operation, was introduced last summer. The Agricultural Research Council has accepted responsibility for monitoring soil, herbage, farm animals, and milk and other foodstuffs, while the Atomic Energy Research Establishment will remain responsible for monitoring air and rain-water and for analysing the radioactivity present in samples of human bone.

The Joint Committee of the Agricultural and Medical Research Councils and the Development Commission on Biological (Non-Medical) Problems of Nuclear Physics, of which Lord Rothschild is Chairman, has been charged with the responsibility for the oversight of this monitoring. To assist it in this task, the Joint Committee has set up a special sub-committee under the chairmanship of Dr. Loutit, Direcor of the Medical Research Council Radiobiological Research Unit.

# News and Comment

## THE FULBRIGHT TRAVEL GRANTS

The United States Educational Commission in the United Kingdom announces that, under the provisions of the Fulbright programme, travel grants are available to citizens of the United Kingdom and dependent territories to go to the United States of America for academic or educational purposes, such as study, research, or lecturing. All awards are competitive and are made by the Board of Foreign Scholarships in Washington upon the recommendations of the Commission.

Graduate students must hold, by the time of departure, at least a good second-class degree or its equivalent and must show proof of admission to an institution of higher learning in the United States for a minimum period of nine months. Grants to graduate students are valid for a period of up to three years but are subject to annual renewal during this time. Candidates must be free of National Service obligations.

Professors, lecturers, and senior research workers should note that it is the objective of this programme that a maximum amount of time be spent in the United States and, therefore, the Commission gives preference to those applicants who intend to spend a full academic year there. Of this, about two-thirds should be spent at one University or recognised research institution. Grants may be extended up to a period of two years, subject to the continuance of satisfactory appointments and dollar support.

All applicants must possess a guarantee of adequate financial support in dollars for the proposed period of the visit to the United States. Since the funds of the Commission are in non-convertible sterling, it is not possible to offer grants for maintenance, tuition, or incidental expenses within the United States.

There are two closing dates in this competition contingent upon the proposed departure date from the United Kingdom. They are:—

March 15th, 1958, for those travelling between June 1st, 1958, and August 15th, 1958; and

June 1st, 1958, for those travelling between August 16th, 1958, and April 1st, 1959.

Applications should be made to: United States Educational Commission in the United Kingdom, 71, South Audley Street, London, W.1.

## WINDSCALE: RESTRICTED AREA

The Minister of Agriculture has announced that radioactivity in milk produced in that part of the restricted area lying in the County of Lancashire has declined to very low levels. He has, therefore, on the advice of the Medical Research Council, authorised the Milk Marketing Board to resume normal collection and distribution of milk produced in the area as from noon last Monday.

## PERSONAL

### Births

BARKER.—On October 23rd, 1957, to Ann, wife of David Barker, B.V.SC., M.R.C.V.S., 46, Musgrave Street, Penrith, Cumberland, a son, Benjamin Philip.

CLAYTON.—On October 30th, 1957, to Alice Kate, wife of N. A. Clayton, B.V.M.S., M.R.C.V.S., 7, Station Road, Long Sutton, Spalding, Lincolnshire, a son, Mark Allen.

RICHARDS.—On November 3rd, 1957, at the Royal Hampshire County Hospital, Winchester, to Sylvia (*née* Pain) and Michael Richards, M.R.C.V.S., a daughter, Claire Penelope.

SIMPSON-WHITE.—On August 28th, 1957, to Sylvia, wife of Patrick Simpson-White, M.R.C.V.S., of Lusaka, N. Rhodesia, a daughter, sister for Amanda.

WADLAND.—On October 31st, 1957, to Jean (*née* Ash), M.R.C.V.S., wife of Harold Wadland, The Cottage, Wardington, Banbury, Oxon, a son.

**Dr. John A. Charlton,** a Canadian veterinary surgeon, has been appointed Parliamentary Assistant to the Minister of Agriculture of the Dominion.

**Dr. John Hammond** was awarded the Herman von Nathusius medal for his work on animal physiology at the recent annual meeting of the German Society for Animal Production at Stuttgart-Bad Cannstatt.

**Brigadier A. G. Heveningham,** C.E.E., and Mrs. Heveningham, have returned from Iraq, and their address is now "Ardcarny," 41, Mansfield Road, Berwick-upon-Tweed.

**Dr. H. Williams Smith,** senior scientific officer of the Animal Health Trust Farm Livestock Research Station at Stock, in Essex, has recently been awarded the doctorate of science of the University of London, for work in the field of bacteriology.

## ECONOMICS OF DOMESTIC PETS

The latest broadsheet to be produced by P.E.P. (Political and Economic Planning) has the title above, and contains a number of points of interest to veterinary surgeons. It is noted, for example, that the number of pet cage birds has increased tenfold since the war, and now exceeds the number either of dogs or cats. The total population of the latter is reckoned to be approximately 3.7 million dogs and 5.2 million cats. Birds are thought to total 6 million.

Another sidelight, so far as veterinary surgeons in small-animal practice are concerned, is the preponderance of working-class people who keep domestic pets, as compared with those better off. Thus, according to a table, "poor" owners are six times more numerous than the "well to do," and four times more numerous than the "lower middle-class." This seems to explain the growth of free clinics, though it was agreeable to see mention of the voucher scheme operated between the R.S.P.C.A. and the profession.

The national expenditure on foods for dogs and cats was estimated to reach a total of £40 million a year, and a note was made of the great expansion of the animal-food industry within recent years. A post-war increase, too, was noted in the export value of pedigree dogs which stands now at about £1 million annually.

The liabilities and assets of domestic pets are assessed in the broadsheet. On the one hand it is suggested that "puppies and kittens often rival female charms as suitable material for advertising copy," and on the other that "it could be held, with much justification, that as a nation we are still far too indulgent towards the presence of dogs—and possibly even more of cats—in food shops."

Under the heading "The cost of pets" occurs the following equivocal gem: "It is impossible to evaluate the happiness and comfort derived by people of all ages from their pets. Even less susceptible to financial assessment, and more disturbing to speculate upon, is the domestic and social turmoil that might arise if the attentions and emotions directed at domestic animals were turned upon fellow creatures!"

## R.C.V.S. OBITUARY

We record with regret the deaths of the following members of the profession:—

HUSTON, Percy Douglas, 8, West View Flats, 1, Baines Avenue, Salisbury, S. Rhodesia, Capt. late R.A.V.C. (S.R.) (Retd.). Qualified December 15th, 1914, at the Veterinary College of Ireland, Dublin. Died August 24th, 1957.

MCNIVEN, Archibald McCullum, of Cooltrim, Bonhill, by Alexandria. Graduated July 20th, 1926, at the Glasgow Veterinary College. Died October 31st, 1957, aged 55 years.

### The Register of Veterinary Surgeons

Under Section 25(3) of the Veterinary Surgeons Act, 1948, and the provisions of Statutory Instrument No. 1150 of 1953, the names of the following members were removed from the Register of Veterinary Surgeons on November 6th, 1957:—

Mr. Francis William Chamberlain, Cheam Village, Sutton, Surrey.

Mr. Thomas Gibson Crawford, Westedge Farm, Gilmerton, Edinburgh.

Mr. Eric Alfred Leaver, Woodborough, High Street, Banstead, Surrey.

Mr. St. John Charles Purcell MacFarlan, c/o 106, Ann Street, Belfast.

Mr. Joseph Alfred Morris, 4, Montague Road, Hounslow, Middlesex.

Mr. Joseph Percy Allen Potts, c/o Lloyds Bank, Aylesbury, Bucks.

Mr. Maxwell de Gruchy Savage, 30, Poole Road, Bournemouth, Hants.

Mr. Samuel Smith, Winton Lodge, North Parade, Horsham, Sussex.

Mr. Hugh Black Watson, Rose Cottage, Dalry, Castle Douglas, Kirkcudbrightshire.

Mr. Ronald Stewart White, Penn House, Hove Park Villas, Hove, 4, Sussex.

*Mr. Peter George Rolls Wilson, Home Farm, Whitehouse, Alford, Aberdeenshire.

Mr. Wilfrid Gordon Willoughby Aston Woollett, 145, London Road, Sheffield, 2, Yorks.

*Subsequently restored to the Register.

Under the provisions of Section 6 of the Veterinary Surgeons Act, 1881, and Section 13 of the Veterinary Surgeons Act, 1948, the name of Mr. Thomas Ernest Johnston, Main Street, Fintona, Co. Tyrone, was removed from the Register of Veterinary Surgeons on October 23rd, 1957.

*Registration in the Supplementary Veterinary Register*

Under the provisions of the Veterinary Surgeons Act, 1948, and the P.D.S.A. Act, 1956, the undermentioned were registered in the Supplementary Veterinary Register on October 4th, 1957:—

Mr. John Wesley Bloom, P.D.S.A. Sanatorium, Woodford Bridge Road, Ilford, Essex.

Mr. Howard Edwin Richard Chitty, P.D.S.A., Stuckeris Street, Cape Town, South Africa.

Mr. Reginald Horne, P.D.S.A., Heron Cross, Booralie Road, Terrey Hills, Sydney, N.S.W., Australia.

Mr. Leonard Joseph Quarrington, P.D.S.A., Tant Hospital, Dudley House, Dudley Avenue, Cowplain, Hants.

These registrations are the result of the above Private Act which was passed by Parliament to correct a deficiency in the main Act and is limited to the four men named.

## PROFESSOR G. H. WOOLDRIDGE

The Memorial Service for the late Emeritus Professor G. H. Wooldridge will be held at Holy Trinity Church, Kingsway (opposite the Holborn, Kingsway, tube station), at 12.15 p.m. on Friday, November 15th, 1957.

## COMING EVENTS

### November

14th (Thurs.). Annual Dinner and Dance of the Victoria Veterinary Benevolent Fund in the Northern Hotel, Aberdeen, 7.30 p.m.

15th (Fri.). First Meeting of the South-east Region of the British Small-Animal Veterinary Association at the Kingsway Hotel, Kingsway, Hove, 6.30 p.m.

18th (Mon.). 8th Annual Dinner-Dance of the University of Bristol Centaur Society at the Berkeley, Bristol.

20th (Wed.). Meeting of the British Small-Animal Association, Midland Region, at The Flying Horse Hotel, The Poultry, Nottingham, 2.30 p.m.

21st (Thurs.). Autumn Meeting of the Dumfries and Galloway Division in the Ernespie Hotel, Castle Douglas, 2.15 p.m.

22nd (Fri.). Ordinary General Meeting of the Royal Counties Veterinary Association at the Caversham Bridge Hotel, Reading, 2.30 p.m.

27th (Wed.). Southern Counties Veterinary Society and N.A.A.S. Joint Grassland Symposium at the Royal Hotel, Winchester, 8.15 p.m.

Meeting of the Scottish Regional Group of the A.V.T. & R.W.s. in the Pathology Lecture Room, The Royal (Dick) School of Veterinary Studies, Edinburgh, 9, 2.15 p.m.

29th (Fri.). Golden Jubilee Dance of the North of Ireland Veterinary Association at the Grand Central Hotel.

## ERRATUM

Our attention has been drawn to a printer's error in last week's issue. In the second column of page 1026, under the sub-heading History of Bovine Salmonellosis on this Farm the first line has been transferred from another page. This line should read: In May, 1946, *S. dublin* was recovered from a cow.

## BRITISH VETERINARY ASSOCIATION QUARTERLY MEETINGS IN LONDON

**Wednesday, November 13th, at No. 7, Mansfield Street.**

10.30 a.m. Small-Animals Committee.
2.00 p.m. Parliamentary and Public Relations Committee.
4.00 p.m. Home Appointments Committee.

**Thursday, November 14th, at No. 7 Mansfield Street.**

10.00 a.m. Veterinary State Medicine Committee.
11.30 a.m. Farm Livestock Committee.
12 noon Finance Sub-Committee.
2.15 p.m. General Purposes and Finance Committee.

**Friday, November 15th, at the Connaught Rooms—**

10.15 a.m. Meeting of Council.

## THE VICTORIA VETERINARY BENEVOLENT FUND

The Annual Dance of the County of Ayr Ladies Guild will be held in Western House, Ayr, on Thursday, November 21st. Tickets, price one guinea, may be obtained from Mrs. A. L. Wilson, 31, Ashgrove Street, Ayr (Telephone: Ayr 65757).

## ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

### Anthrax

*Northants.* Nr. Ditchford Railway Station, Northants (Oct. 30).

*Somerset.* Higher Bridge Farm, Godney, Wells (Oct. 28).

*Staffs.* Bottom Field, Cuckoo Farm, Lightwood, Longton, Stoke-on-Trent; Bridge Farm, Wheaton Aston (Oct. 28).

*Sussex.* Church Farm, Sompting, Worthing (Nov. 1).

### Fowl Pest

*Denbigh.* Rhos Farm, Llanrwst (Oct 31)

*Essex.* Greenacre Smallholding, Hydewood Lane, Canewdon, Rochford (Oct. 31); Weymarks Farm, Bradwell on Sea, Southminster (Nov. 1).

*Herts.* Paradise Piggeries, Paradise Hill, Wormley, Broxbourne; Springfield Piggeries, Wormley, Broxbourne (Oct. 30); Wormley Hill House, Wormley, Broxbourne; Home Farm, Bell Lane, Broxbourne (Nov. 3).

*Kent.* Sunbeam, Sweechbridge Road, Hillborough, Herne Bay; Hill View, Bekesbourne, Canterbury (Oct. 30); Biddenden Poultry Farm, Biddenden, Ashford (Oct. 31); The Oaklands, Headcorn, Ashford (Nov. 3).

*Lancs.* New Hey Farm, Newton Kirkham, Preston; Ravenscroft, Liverpool Road, Much Hoole, Preston; Lunds Lane Farm, Much Hoole, Preston; Lancashire Institute of Agriculture, Hutton, Preston (Oct. 28); Fern Bank, Town Lane, Much Hoole, Preston; Holmes Farm, Brindle, Chorley; Moorfield, Six Acre Lane, Longton, Preston; Guest Farm, Runshaw Lane, Euxton, Chorley; Sunnydene, New Hey Lane, Newton, Preston (Oct. 30); Marches Farm, Royton, Oldham; Shore Road, Banks, Southport; Dunjohn Farm, Skip Lane, Hutton, Preston (Oct. 31); Matthews Farm, Marsh Road, Banks, Southport (Nov. 1); Runshaw

Moor Farm, Runshaw Lane, Euxton, Chorley; Barbers Farm, Town Lane, Much Hoole, Preston; Grange Nurseries, Church Lane, Wingate, West Houghton, Bolton; Brookfield, Blackgate Lane, Tarleton, Preston (Nov. 2).

*Norfolk.* Clint Green, Yaxham, Dereham (Oct. 28).

*Suffolk.* The Stores, Bedfield, Woodbridge; Rathkeltair Lodge, Fornham St. Martin, Bury St. Edmunds (Oct. 29); Pearmans Farm, Holywell Row, Mildenhall, Bury St. Edmunds (Nov. 1); The Arches, Barton Mills, Bury St. Edmunds; North View, Wickhambrook, Newmarket; Grove House, Higham, Bury St. Edmunds; Opposite the Church, Wesley, Newmarket; 12, Eriswell, Brandon; West Lodge, Elvedon, Thetford, Norfolk (Nov. 2); 5, The Street, Town Street, Brandon (Nov. 3).

*Sussex.* Ridgeland Farm, Crowhurst Road, St. Leonards on Sea (Nov. 2).

*Yorks.* Went Farm, Womersley, Doncaster (Oct. 29), Top House Farm, Womersley, Doncaster (Nov. 1).

### Swine Fever

*Ches.* Coneygreaves Farm, Little Budworth, Tarporley (Oct. 28).

*Denbigh.* Rhos Farm, Llanwrst (Oct. 31).

*Leeds.* Clayton House, Ring Road, Leeds, 16 (Oct. 30).

*Leics.* Woodcock Farm, Rothley (Oct. 29).

*Norfolk.* Southward, Yarmouth Road, Witton, Norwich; Foulsham Road, Bintree, Norwich (Nov. 1).

*Salop.* Round House, Cound, Shrewsbury (Oct. 28); White House Farm, Hemford, Minsterley, Shrewsbury (Oct. 29); Harbour Farm, Cound, Shrewsbury (Nov. 1).

*Somerset.* Goldhills Lane, South Cheriton, Templecombe (Oct. 29); Tower View, Hardway, Bruton (Oct. 30).

*Surrey.* Lynton Poultry Farm, Lucas Green, West End, Woking (Oct. 28).

*Yorks.* Hill Top Farm, Crabb Lane, Bilton, Harrogate (Nov. 1).

## CORRESPONDENCE

***The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.***

### Radioactivity Risks for Animals

Sir,—Dr. Hare's letter published in your columns under this heading has emphasised that here is a subject on which the veterinary profession in this country is very ill-informed. The Windscale accident, we hope, has been an isolated one, but with an accelerated programme of research being developed by the atomic energy industry, the manufacture and stock-piling of nuclear weapons in the British Isles, and the apparently permanent tension between East and West, the likelihood of a major nuclear explosion is a very real danger. Since serious radioactive fallout can occur at distances of many hundreds of miles from the actual explosion, we are at risk not only from our own islands but also Northern Europe and possibly even further afield.

I think it unlikely that the consequences of serious radioactive fallout on farm animals are appreciated by our profession, nor is the rôle veterinary surgeons would have to play if, in fact, they were alive! Maybe the information is available in this country and an emergency programme has been prepared; possibly also the Animal Health Division, the Atomic Energy Commission or whoever has compiled these data feels that they should be withheld at this time. What is important, though, is that we are *potentially* at risk.

In the U.S.A. the Department of Agriculture has published a bulletin on this subject. In Canada the C.V.M.A. has recently published a paper "to bring details about radioactive fallout to the attention of the profession." These publications make disquieting reading but some minor consolation is gained from the fact that a certain amount of valuable knowledge, which will have to be applied by the veterinary profession, is available. Also many papers, mainly of U.S. publication, have appeared on specific effects of radiation in animals. A recent annotation in the BRITISH MEDICAL JOURNAL, on the Windscale accident also provides some useful information on the metabolism and effect of radioactive iodine in man and animals.

If information is not forthcoming from an official source in this country, I hope that the B.V.A. will see that the relevant available literature is reviewed and published in the columns of THE VETERINARY RECORD. Not only should we be equipped as well as possible to cope with such emergencies, but both we and the agricultural industry should be fully acquainted with the effects of thermo-nuclear explosions and radioactive fallout.

Yours faithfully,
BRUCE V. JONES.

The Oaks,
Clavering,
Nr. Saffron Walden, Essex.
*November 4th*, 1957.

#### References

"Accident at Windscale." (1957). Annotation, *Brit. Med. J.* **2**. 991.

CANADIAN VETERINARY MEDICAL ASSOCIATION. (1957). "Radioactive Fallout." *Can. J. Comp. Med.* **21**. 325-7.

U.S. DEPARTMENT OF AGRICULTURE. "Radioactive Fallout on the Farm." Bulletin No. 2107.

### The "Rights" of Animals

Sir,—I have read the letter from Mr. Hugh Thornton and the three letters provoked by his remarks.

Apparently Mr. R. H. Smythe is outraged that anyone should quote the Bible as an authority, thinks man is the result of something which " went amiss," regards man as only a more cunning animal which has only the same rights as the less cunning animals, and at the same time has the duty of protecting these less cunning animals! Does he think, perhaps, that some day there will appear a Shakespeare, a Beethoven, a Pasteur among these less cunning and less crafty animals?

Major Wilkins thinks Mr. Thornton's philosophy, *i.e.* St. Thomas Aquinas's and Cardinal Newman's philosophy, " a trifle muddy "—indeed a lofty pinnacle of judgment, to use his own phrase. He is sure that all of us have met animals with " perfectly genuine souls." Does he mean that certain species of animals have souls like those of human beings or that only certain individual animals have souls?

Major Hume is quite correct, of course, in saying that Thomist philosophy is not binding on the conscience of anyone and also that St. Thomas Aquinas derived much of his philosophy from Aristotle; but surely Major Hume does not mean that Aquinas promulgated all the beliefs and teachings of the Greeks and Romans! He also says " We get the notion of right and wrong from our conscience which prescribes duties," *i.e.* he asserts that man can work out a code of ethics by reason alone.

But some Papuan tribes think it is quite right to kill their first-born children and feed their pigs with the corpses; they also think it quite right to kill their aged parents. Is reason sufficient? Is authority not required?

As I read it, Mr. Thornton's letter was a protest against the excessive sentimentality of some animal lovers. He quoted several eminent authorities in support of his opinions. His critics do not appear to have any authorities of contrary opinions.

Yours faithfully,
C. A. McGAUGHEY.

University of Ceylon,
Dept. of Veterinary Science,
Peradeniya,
Ceylon.

*October 31st*, 1957.

Sir,—The same morning that I read Mr. Fuller's last letter I tested 73 cattle. Following his advice I looked them all, as an old Irish friend of mine would put it, straight in the optic. I am sorry to say, I saw no sign of the divine spark. Perhaps my myopia was to blame.

If immortality is now to be reckoned one of the rights of animals, in England if nowhere else, are parasites to be granted this privilege? Trypanosomes and tapeworms are undoubtedly alive; why should they be denied their chance of eternal happiness? Do they continue a parasitic life, and if so what hosts are provided for them?

Mr. Smythe's lion may kill only for food, but the fox certainly kills for fun. There must be many a decapitated hen who would have been an enthusiastic supporter of blood sports if her opinion had been asked.

The strange forbearance that he advocates has some followers in India, I believe. These gentlemen always walk about with their eyes on the ground, and carry a small brush gently to sweep aside any visible form of life that they might tread on. This would preclude the use of a car. Mr. Smythe might be interested in joining them. His practice might suffer but his conscience would be at rest.

Yours faithfully,
A. L. BONGARD.

5, Ann Street,
Enniskillen,
Co. Fermanagh.

*October 29th*, 1957.

Sir,—In connexion with correspondence on this subject, may I quote the words of the late Professor W. MacNeile-Dixon in his Gifford Lectures at Glasgow University, 1935-7. Having dealt with the failure of Christianity to give a convincing explanation of our present plight and future fate, he went on:—

"And there is a similar silence in respect of the animal world. Their status in God's creation is overlooked. They are not thought of as concerned in the Fall, as sinful, as in need of grace or redemption, or as having any share in a future life. Presumably in heaven we shall never meet with them, and some of us will miss our favourites, birds, or dogs, or horses. If animals were not, like ourselves, sufferers, condemned like us to death, that silence might somehow be explained. But death, we are told, entered the world through sin, and though not partakers in sin, they partake of death, its consequence. Nor does it appear that they have any rights of any kind, nor we any duties in respect of them. We may, it seems, treat them according to our good pleasure."

It must, indeed, be allowed that for the most part the philosophers treat them with a like indifference. Kant could find no better reason for the kind treatment of animals than the fear that lack of sympathy with them might blunt our human sympathies. How much nobler were Plutarch's sentiments; the poets, without exception, stand by them.

"If aught of blameless life on earth may claim
Life lighter than death, though death's dark wave rise high,
Such life, as this among us never came,
To die."

Yours faithfully,
DONALD BAIN.

The Bungalow,
Oldmeldrum Road,
Newmachar,
Aberdeenshire.

*October 28th*, 1957.

Sir,—A celebrated member of the Cecil family has been credited with the remark, "If you believe the doctors nothing is wholesome; if you believe the theologians nothing is innocent; if you believe the generals nothing is safe. They all require to have their strong wine diluted by a large admixture of insipid common sense." Might one, with all temerity, assert that the principles of reproduction have been established beyond dispute and that it is purely a matter of chance, if the results are born, "above or below the salt." It is futile to enter into a discussion as to the ultimate fate of all species when life, as we understand it, becomes extinct. So far as the veterinary profession is concerned, the "rights" of its patients are clearly understood, and the time has now arrived when it should take effective steps to ensure that their treatment rests wholly in its hands. At the present time, remedies ranging from milk fever injections to implants can be bought over the chemist's counter with results, in not a few instances, not beneficial to the recipient.

Yours faithfully,
J. F. D. TUTT.

"Rothiemurchus,"
Winchester.

*November 2nd*, 1957.